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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 1801

02 AERODYNAMICS 1801

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 1804

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 1805

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 1806

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 1809

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 1809

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 1811

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 1813

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) 1813

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

13 ASTRODYNAMICS 1814

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) 1815

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

15 LAUNCH VEHICLES AND SPACE VEHICLES 1817

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 1818

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING 1819

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 1820

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION 1821
For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER 1821
Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.
For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) 1823
Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS 1823
Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY 1825
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS 1827
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS 1831
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS 1833
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics*.

31 ENGINEERING (GENERAL) 1834
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 1834
Includes land and global communications; communications theory; and optical communications.
For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING 1843
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.
For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER 1847
Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.
For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY 1853
Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.
For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS 1856
Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 1859
Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 1865
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 1866
Includes structural element design and weight analysis; fatigue; and thermal stress.
For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) N.A.

43 EARTH RESOURCES 1870
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 1875
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 1878
Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 1880
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 1884
Includes weather forecasting and modification.

48 OCEANOGRAPHY 1889
Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 1890
Includes genetics.

52 AEROSPACE MEDICINE 1894
Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 1896
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 1896
Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.
Includes exobiology; and extraterrestrial life.

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Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 1897
Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

61 COMPUTER PROGRAMMING AND SOFTWARE 1899
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS 1902
Includes computer networks.

63 CYBERNETICS 1903
Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 1905
Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 1910
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 1913
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 1913
Includes topology and number theory.

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Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.
For related information see also *Engineering*.

70 PHYSICS (GENERAL) 1914
For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar Physics*.

71 ACOUSTICS 1915
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution.*

72 ATOMIC AND MOLECULAR PHYSICS 1916
Includes atomic structure and molecular spectra.

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Includes magnetohydrodynamics and plasma fusion.
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76 SOLID-STATE PHYSICS 1922
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77 THERMODYNAMICS AND STATISTICAL PHYSICS 1926
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 1927
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 1928
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS 1929
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 1929
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1929
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 1931
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1932
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1934
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 1934
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1934
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX I-1
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CORPORATE SOURCE INDEX I-51
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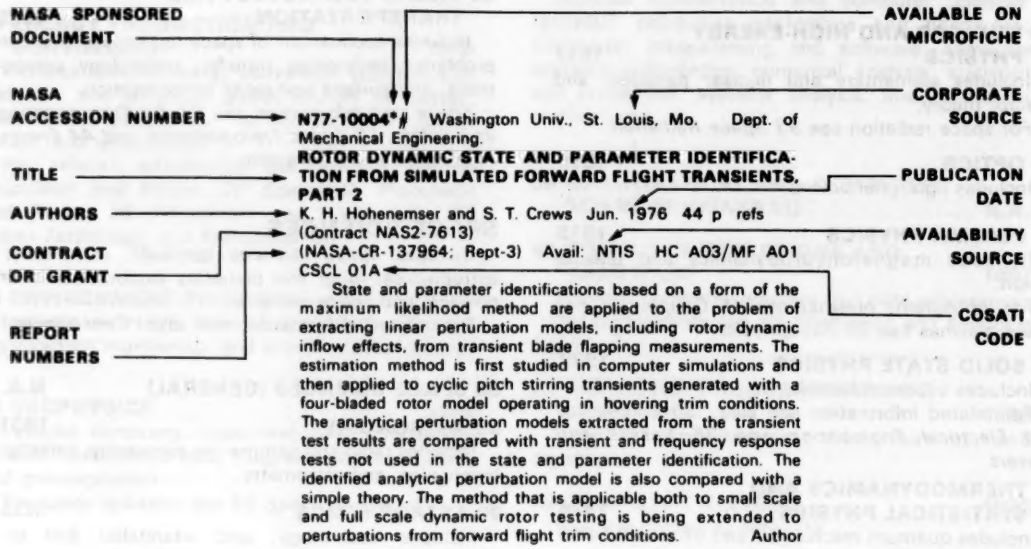
REPORT/ACCESSION NUMBER INDEX I-69

TYPICAL CITATION AND ABSTRACT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NASA ACCESSION NUMBER
CORPORATE SOURCE
N77-10004*# Washington Univ., St. Louis, Mo. Dept. of Mechanical Engineering.
TITLE
ROTOR DYNAMIC STATE AND PARAMETER IDENTIFICATION FROM SIMULATED FORWARD FLIGHT TRANSIENTS, PART 2
PUBLICATION DATE
AUTHORS
K. H. Hohenemser and S. T. Crews Jun. 1976 44 p refs
(Contract NAS2-7613)
AVAILABILITY SOURCE
CONTRACT OR GRANT
(NASA-CR-137964; Rept-3) Avail: NTIS HC A03/MF A01
CSCL 01A
COSATI CODE
REPORT NUMBERS
State and parameter identifications based on a form of the maximum likelihood method are applied to the problem of extracting linear perturbation models, including rotor dynamic inflow effects, from transient blade flapping measurements. The estimation method is first studied in computer simulations and then applied to cyclic pitch stirring transients generated with a four-bladed rotor model operating in hovering trim conditions. The analytical perturbation models extracted from the transient test results are compared with transient and frequency response tests not used in the state and parameter identification. The identified analytical perturbation model is also compared with a simple theory. The method that is applicable both to small scale and full scale dynamic rotor testing is being extended to perturbations from forward flight trim conditions. Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, TURBINE ENGINE LOW ASPECT RATIO TECHNOLOGY
W. WATERMAN, Garrett Corporation, *Phoenix, Arizona* 85034 (DF456730; F33615-74-C-2017)

This program extends the successful technology of AF Contract F33615-68-C-1208 to low aspect ratio turbine blade problems, especially for high-temperature cooled blades.

A time phased effort to identify the loss mechanisms of low aspect ratio cooled turbines will be pursued. Cold stationary and rotating rigs will be used to verify loss mechanisms and evaluate methods to reduce these losses. The approach to this improvement is expected to extend the work of F33615-68-1208.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory TBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0002, IMPORTANCE OF AUTOPILOT INTERACTION IN FLUTTER ANALYSIS
W.P. RODDEN, Unknown Inst. or Indiv. Grant, *California* (DN590137; N00019-76-C-0346)

To increase the present lifting surface flutter analysis capability through inclusion of autopilot system characteristics.

Work will consist of three major tasks: (1) program of aeroservo- elastic-stability modifications; (2) nonlinear stability; analysis and (3) evaluation of interaction effects.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - D.N.A.

1.0003, HEAD-UP DISPLAY (HUD) DESIGN
R.S. JACOBS, Hughes Aircraft Company, *Culver City, California* 90230 (DN781223; N62269-76-C-0231)

To procure a head-up display (HUD) systems study hologram based on new technologies of light generation, light modulation, and holographic optics in order to determine the best course of advanced development for a HUD to be used in naval aircraft of the 1980 era. This contract will support work unit ZA101, agency accession no. DN681080.

Initiate a design study to investigate the application of new technologies for HUD systems and present quantified tradeoffs of their individual characteristics.

ADDENDA: Supporting agency address is: NADC Air Vehicle Technology Dept., Warminster PA

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0004, WAVE DRAG REDUCTION FOR AIRCRAFT FUSELAGE/WING (PHASE II)
C.W. CHU, Northrop Corporation, *Hawthorne, California* 90250 (DN681044; N62269-75-C-0537)

To extend the wave drag minimization analytical design method developed for the Navy under contract no. N62269-74-C-0470 to include the effects of the total wing and wing/body blending. The contract supports work unit NN701, agency accession no. DN481077.

Employing the phase I analytical methodology, a new set of wing and wing/body blending geometric constraints will be established and incorporated into a 5-element Latin square to generate 25 perturbated wave drag calculations, concurrently developing an extended empirical wave drag equation against a combination of a 3-dimensional method of characteristics and linearized thin-wing theory. Coefficients of the empirical equation will be developed to provide a least-value wave drag prediction. The F-4 will again serve as the baseline example design.

ADDENDA: Supporting agency address is: Naval Air Development Center Air Vehical Technology Dept., Warminster PA

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0005, AIRCRAFT DESIGN - TRANSONIC AREA RULE
M. HAFEZ, Flow Research Incorporated, *Los Angeles, California* 90045 (DN675530; N00014-76-C-0880)

The recently developed transonic area rule with lift is becoming an extremely important tool for the design of aircraft configurations. The proposed investigation will explore, theoretically, the range of validity of the area rule in terms of such parameters as: Mach number, angle of attack, thickness ratio and the sweep for representative aircraft configurations.

The power of the area rule for design is that it masks out details which, in an asymptotic sense, do not contribute significantly to the structure of the transonic flow field. The theory provides, relatively simply, the global characteristics of the configuration. In order to assess the range of validity of the theory as non-asymptotic deviations become more pronounced, more exact numerical calculations will be made for a range of configuration parameter and compared with the area rule predictions.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0006, FLIGHT/PROPULSION CONTROL COUPLING AND DYNAMIC INTERACTION
R.L. HEIMGOLD, Lockheed Electronics Co. Inc., *Los Angeles, California* (DF138280; F33615-76-C-3128)

Currently, suitable techniques are not available for analysis and synthesis of dynamic interactions between flight and propulsion controllers on military aircraft, for purposes of developing control coupling techniques. The objective of this program is to develop methods and data base for design and implementation of flight/propulsion control coupling (FPCC) systems in fighter aircraft. In flight/propulsion control coupling, functional control parameters and system elements are blended to enable cooperative dynamic operation, with potential dramatic improvements in maneuverability, agility, air superiority, and airframe propulsion compatibility. Jet flap and vector thrust classes of aircraft are to be considered.

The program will extend and refine the preliminary design of combat flight control modes for the jet flap aircraft which was developed in project 19870254. Emphasis will be on deceleration

and turning modes, and integration with aircraft and engine stability loops. The areas of control, aerodynamic, and functional interaction between propulsion system, control surfaces, and airframe will be identified by review of past and current research and development, and problem areas experienced on modern military aircraft in the inventory. Maximum utilization will be made of available control technology and computer simulations in the respective areas of aerodynamics, flight control, and propulsion dynamic analysis to develop the analytical tools for evaluation of control interaction. Detailed analysis and simulation will be performed on the configuration selected, to define interaction parameters, and generate control coupling requirements. Plans for flight demonstration will be outlined.

ADDENDA: Supporting agency address is: Af Flight Dynamics Laboratory FGL, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0007, HOLOGRAPHIC LENS DEVELOPMENT FOR FUTURE NAVAL AIRCRAFT

D. CLOSE, Hughes Aircraft Company, *Malibu, California* 90265 (DN781222; N62269-76-C-0188)

To demonstrate capability of a holographic lens system and initiated associated material and design improvements. A model holographic lens system will be developed to interface with a P-43 phosphor CRT display. The contract supports work unit ZA101, agency accession no. DN681080.

Conduct development of holographic materials and hologram formation techniques. Investigate and develop special control methods to produce a reflective simulated array hologram sensitized to 5145A (P-43). This continuous lens will be designed to comply with NavAirDevCen specifications for a hologram lens as a design goal.

ADDENDA: Supporting agency address is: NADC Air Vehicle Technology Dept., Warminster PA

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0008, FLIGHT TECHNIQUES PROGRAM

D.M. LAYTON, U.S. Navy, Postgraduate School, *Monterey, California* 93941 (DN498067)

Provide a multi-engine, light, general aviation aircraft which will be instrumented by NPS to provide the parameters necessary to perform in-flight data acquisition for laboratory sections of regularly scheduled classes in the Department of Aeronautics, Naval Postgraduate School.

A low-time aircraft to be obtained by lease agreement which shall include maintenance, hangaring and support, minimum instrumentation to be installed in a modular form which will permit easy installation and removal. A pilot qualification procedure will be implemented to insure only qualified pilots are in command. Detailed test plans will be prepared for each flight event.

ADDENDA: Supporting agency address is: Naval Air Systems Command 3200, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0009, EXPEDITIONARY HANGAR

R.H. SEABOLD, U.S. Navy, Civil Engineering Lab., *Port Hueneme, California* 93041 (DN587034)

To develop two portable, containerized, locarch hangar structures, one 76 feet wide, 88 feet long, and 25 feet high, the other 140 feet wide, 130 feet long, and 47 feet high. Both shall be transported in ISO type 1C containers and erection and striking shall require only simple hand tools, manpower, and portable hand-operated winches.

The Air Force Civil Engineering Center, by contracting, will use the locarch concept to design, fabricate, and test a prototype of both structures. Funds for the procurement of the smaller prototype were provided by the Civil Engineer Support Office (CESO), Naval Construction Battalion Center, Port Hueneme, CA.

ADDENDA: Supporting agency address is: Naval Facilities Engineering Command (032A), 200 Stovall Street, Alexandria, VA 22332

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0010, HIGH PLATFORM AEROSTAT

L. WERNER, Thompson Ramo Wooldridge Inc., *Redondo Beach, California* 90278 (DN680197; N00173-76-C00056)

A lightweight, flexible solar array shall be designed and fabricated which will deliver 10 kilowatts of power in normal sunlight conditions while operating at a plus 60 deg. C temperature in the 60-70 thousand foot altitude range. This array will be of modular design, with module flexibility and strength being sufficient to permit attachment and launch on a high-altitude superpressured powered aerostat (HASPA) balloon system.

The contract will be carried out in two phases: (1) design and (2) fabrication. The basic design will utilize N-on-P silicon solar cells attached to a kapton backing sheet and utilize printed wiring. As a baseline design, 10 kw of power at 200 VDC and an operating temperature of 60 deg. C will be delivered. Each solar array will have a power-to- weight ratio approaching 87 watts/lb.

ADDENDA: Supporting agency address is: Naval Research Laboratory (5725), Washington, D.C. 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0011, PERFORM A STUDY OF THE SENSITIVITY OF CONTROL POWER REQUIREMENTS FOR STATISTICALLY UNSTABLE FIGHTER AIRCRAFT

A.L. GREENSITE, General Dynamics Corporation, *San Diego, California* 92112 (DN590039; N00019-75-C-0355)

A driving factor in the control power requirements of the aerodynamically unstable aircraft is its susceptibility to upset following external disturbances, such as winds and gusts. The objective is to obtain data useful in arriving at rational design criteria and margins of safety needed for control power in aerodynamically unstable aircraft.

The contractor will determine critical flight conditions for two aerodynamically unstable aircraft configurations. Gust upset boundaries will be established for each configuration by time history response to discrete gust modes. Gust amplitude shall be correlated to the probability of occurrence through the continuous random model and discrete gust response will be compared to the continuous random gust response.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0012, NAVY VEHICLE DESIGN AND CONSTRUCTION - PREDICTION OF HOT GAS REINGESTION EFFECTS ON VTOL AIRCRAFT

A. KAREMAA, General Dynamics Corporation, *San Diego, California* 92138 (DN675408; N00014-76-C-0698)

The objective is to formulate an improved methodology for predicting lift loss effects in VTOL aircraft during hovering flight modes. These lift losses result in large decreases in mission capabilities due to excessive fuel consumption. Improved predictive capabilities are needed to more accurately define the propulsive requirements for future VTOL aircraft designs.

Lift losses are due to both near-field and far-field recirculation of the hot jet exhaust gases. This research effort will investigate both flow regimes in a time-phased manner. In this current effort, emphasis is being placed upon developing an improved understanding of the aerodynamic and thermodynamic characteristics of the near-field fountain flow regime. The approach is three pronged. First aerodynamic and thermodynamic models will be developed from theoretical considerations. Next tests will be performed to measure needed aero and thermal characteristics and their sensitivities to various geometrical parameters, and thirdly, the test results will be compared with the analytic models for improvement and refinement of the analytical expressions.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0013, ENVIRONMENTAL NOISE DATA SYSTEM

R.S. GALES, U.S. Navy, Undersea Sciences Department, *San Diego, California* 92132 (DN588596)

Validate methodology and instruments for acquisition of community noise data in the vicinity of air installations, in a manner that is maximally cost effective and compatible with current EPA guidelines, and which serves needs of the NEPSS and the air station command.

Specify, procure, and test portable noise-monitoring equipment with direct digital printout of the noise in the community and of noise of individual aircraft. Compare utility of such equipment with that of conventional sound-measuring instruments as to reliability, simplicity of use, training time, initial and upkeep cost. Investigate the change of community noise with distance and direction from an air installation. Monitor noise in the community and from individual aircraft at a typical naval air station, to validate guidelines for the selection of monitoring sites and direct reading instruments, and for updating noise contours around an air installation. Specify, procure, install, and evaluate prototype system at NAS Miramar.

ADDENDA: Supporting agency address is: Naval Facilities Engineering Command (NFAC) (NFAC 032B), 200 Stovall Street, Alexandria, VA 22332

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0014, ADVANCED ENGINE SIMULATION

A.L. RICHEY, United Technologies Corp., *Hartford, Connecticut* 06108 (DF459200; F33615-76-C-2048)

Establish a procedure that provides technical direction and guidance to the development of advanced propulsion system concepts yielding improved system performance.

The procedure will be developed by logically and systematically interpreting the technical data base, generated in phase I of the turbine engine variable cycle selection programs, to identify advanced propulsion system concepts, advanced scheduling/control system concepts and advanced component technology requirements that yield improved system performance.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory TBA, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0015, AEROCRANE 33' MODEL FLIGHT TESTS

W.F. PUTNAM, All Amer. Engineering Company, *Wilmington, Delaware* 19899 (DN590067; N00019-75-C-0418)

Conduct instrumented flight tests of a 33' model aerocrane to provide gross performance, trim, stability and control data on the 'aerocrane configuration.' The aerocrane may provide the Navy and Marine Corps with cost-effective crane services in remote areas and at sea for store transfers, amphibious assault support, forward harbor construction, submarine rescue and other applications.

The performing organization will complete engineering and fabrication to modify the existing 0.1 froude scaled aerocrane model to provide proportional remote control and increased power for propulsion; install instrumentation and provide a monitoring station; conduct flight tests in a government airship hangar; reduce flight test data, and analyse data.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0016, GUIDED PROJECTILE RESEARCH

G.E. AIELLO, Martin Marietta Corporation, *Orlando, Florida* 32805 (DN590578; N00024-76-C-5305)

Perform aerodynamic research to provide tools for rapid and accurate selection of tail, wing or canard controlled aerodynamic configurations for gun-launched guided projectiles.

Use the computer-aided missile synthesis (CAMS), a missile design computer code, to determine aerodynamics of tail control configurations examined under contract N00017-73-C-4334, determine aerodynamic performance of controlled guided projectiles, and organize information to facilitate rapid selection of 5-inch and 8-inch guided projectiles.

ADDENDA: Supporting agency address is: Naval Sea Systems Command, Washington, D.C. 20362

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0017, REMOTELY PILOTED VEHICLE (RPV) PILOT TRAINER

F. CHEA, U.S. Navy, Electronics & Acoustics Lab., *Orlando, Florida* 32813 (DN494041)

Perform a study to determine technical parameters and approaches for simulation of remotely piloted vehicles. The rapid advancement of RPV technology encompasses the conversion of many older piloted aircraft to RPV's as well as the development of a whole new family of RPV's. Missions for the RPV's will be varied and include reconnaissance, airborne fire-control systems, kamikaze-type missions, observation platforms, high-altitude supersonic target drones, and air-to-ground weapons delivery. The apparent large number of vehicle crashes in the field indicated there is a growing need for training RPV operators on simulators rather than on the operational RPV's.

Research the literature and RPV programs; review proposed RPV designs; review critical training areas; develop baseline simulator methodology; fabricate breadboard of baseline simulator; perform man-in- loop simulation evaluation and report results and recommendations.

ADDENDA: Supporting agency address is: Naval Air Systems Command Instrumentation and Flight Controls, Washington, D. C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0018, AVIATION WIDE-ANGLE VISUAL SYSTEM

W. YIH, U.S. Navy, Computer Laboratory, *Orlando, Florida* 32813 (DN494048; N61339-75-C-0009)

To demonstrate the feasibility, capability and training effectiveness of a wide-angle visual system with a high-resolution target image and to integrate it with a flexible cockpit-motion visual facility which will provide an experimental basis for the development of future advanced flight simulators and visual systems.

A feasibility model of a wide-angle visual system for CTOL (conventional takeoff and landing) aircraft simulation will be developed on contract and integrated with a flight simulator research tool. The visual system will have two independent projectors and a wide-angle screen. The projectors and screen will be mounted with a cockpit on a motion platform. A wide-angle projector will display the background scene over a wide area while a narrow-angle target projector will provide a high-resolution target image over a smaller area. A flexible image storage system will include 3-dimensional models, 2-dimensional film and special effects imagery.

ADDENDA: Supporting agency address is: Naval Training Equipment Center Electronics and Acoustics Lab, Orlando, FL 32813

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0019, DEVELOPMENT OF ORGANIC MATRIX COMPOSITE AIRCRAFT ENGINE COMPONENTS

J. WINFREE, United Aircraft Corporation, *West Palm Beach, Florida* 33402 (DN590173; N00019-76-C-0499)

To provide lower cost, lighter weight external components for military aircraft gas turbine engines using organic matrix composite materials.

Investigate composite molding techniques such as compression molding, lay-up, and winding. Investigate composite materials such as graphite reinforced polyimides. Design, fabricate and test prototype parts in the laboratory.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0020, ENVIRONMENTAL DEGRADATION OF STRESSED AND UNSTRESSED SANDWICH PANELS

K. HOFER, Illinois Inst. of Technology, Graduate School, *Chicago, Illinois* 60616 (DN781168; N62269-76-C-0237)

To investigate the effect of different environmental exposures on stressed and unstressed sandwich panel construction.

Graphite/epoxy faced adhesively bonded honeycomb core construction will be exposed to a variety of environments, both in a cumulative and cyclic fashion. This sandwich panel construc-

tion will be exposed and placed in a state of stress most simulating actual service conditions on naval aircraft.

ADDENDA: Supporting agency address is: NADC Air Vehicle Technology Dept., Warminster PA

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0021, SERVICE EVALUATION OF BQM-34E GRAPHITE/EPOXY WINGS

D. RUCK, Fairchild Space & Elect. Co., *Hagerstown*, *Maryland* 21740 (DN581065; N62269-74-C-0366)

To demonstrate the service durability and structural reliability of advanced fiber-reinforced composite aircraft structures under Navy operational usage. To determine the reproducibility of such structures when produced by a pilot-production program and to provide realisitic production cost data which can be used as a basis for future economic projections. This work is in support of work unit ZA101, Aircraft Technology, agency accession no. DN681080.

Four composite wings for the BQM-34E unmanned aerial target will be fabricated according to a NavAirDevCen design, using manufacturing methods that will be suitable for full-scale production. Production costs will be closely monitored. The components will be installed on existing BQM-34E drones and subjected to normal service usage. The condition of these wings will be monitored periodically over the life of the drone. (Note the service evaluation of the composite wings is not included in the contract.)

ADDENDA: Supporting agency address is: Naval Air Development Center Air Vehicle Technology Dept., Warminster, PA 18974

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0022, RETARDATION SYSTEM REPEATABILITY

J. MCNELIA, U.S. Navy, Ballistics Department, *Silver Spring*, *Maryland* 20910 (DN585069)

The Navy uses parachutes to retard and stabilize many of its air- delivered weapons and payloads. With the advent of improved bombing systems, more concern is being directed toward the ballistics of the retarded weapons. The objective of this study is to determine the effect of filling time variations and fabrication tolerances on the repeatability of various retardation systems.

It is proposed to design and construct models of ribbon and cross parachutes which represent terminal velocities between 100 and 300 feet per second. These models will be flight tested from a whirl tower in order to minimize variations in launch velocity, launch altitude, and angle. Impact dispersion will be correlated with filling time, tolerances, range to impact, and time of flight.

ADDENDA: Supporting agency address is: Naval Air Systems Command AIR-320C, Washington, D.C. 20362

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0023, GUST RESPONSE ALLEVIATION FOR A HINGELESS HELICOPTER ROTOR IN CRUISING FLIGHT

E.A. WITMER, Mass. Inst. of Technology, School of Engineering, *Cambridge*, *Massachusetts* 02139 (DN590121; N00019-76-C-0278)

Helicopters utilizing rotors with hingeless blades show great promise for future military and commercial applications. Much of the technology required for the development of such aircraft is available, but adequate understanding of the aeroelastic response of large flexible rotor blades to atmospheric turbulence has not yet been achieved. Such understanding is necessary during the preliminary design phase in evaluating the fatigue characteristics of the rotor and ride qualities of the vehicle, and, if necessary, in the development of suitable gust alleviation devices.

The contractor will derive the equations for the motion and bending stresses of a typical hingeless rotor due to vertical atmospheric turbulence during cruising flight; investigate theoretically the use of an active blade pitch control to reduce the blade bending stresses due to vertical atmospheric turbulence; and investigate theoretically the use of blade tuning to alleviate blade stresses due to vertical atmospheric turbulence.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0024, HIGH-ALTITUDE SUPERPRESSURED POWERED AEROSTAT (HASPA)

J. MCELROY, General Electric Company, *Lynn*, *Massachusetts* 01910 (DN585220; N60921-74-C-0274)

Design, fabricate, and deliver a 0.5 to 3.0 kw, H2 - 02 fuel cell, power system for HASPA. This work unit summary supports DN485034.

The existing fuel cell stack built by General Electric under a NASA technology development program will be the basis for this fuel cell power system. A preliminary power system design will be drawn up and submitted for Navy approval. The fuel cell will be integrated with the instrument bay.

ADDENDA: Supporting agency address is: Naval Surface Wpns. Cen. W.O. Lab Research and Technology Dept., Silver Spring, MD 20910

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0025, NAVY VEHICLE DESIGN AND CONSTRUCTION - HIGH ANGLE OF ATTACK STABILITY AND CONTROL

R. STENGEL, Analytic Sciences Corporation, *Reading*, *Massachusetts* 01867 (DN575168; N00014-75-C-0432)

At high angles of attack the flying qualities of most high- performance aircraft deteriorate due to undesirable characteristics such as wing rock or departure from controlled flight. These characteristics significantly reduce tracking capability and maneuverability, and can lead to loss of control and difficult or impossible recovery problems. The objective of this program is to develop an analytical framework of study for the high-angle-of-attack stability and control problem, and to identify designs of departure preventing control systems.

This second year's work will treat new technical areas by considering unique aircraft configurations, and by applying analytic methodologies to the theoretical basis previously developed. Task I will provide a description of the high-angle-of-attack stability of a Navy combat aircraft and will assess the effects of flight at transonic and supersonic speeds. Task II will treat active control concepts for improved maneuverability. Task III will establish the effects of piloting actions with emphasis on performance improvements possible with improved control systems. Task IV will apply the multivariable limit cycle analysis technique to aircraft models containing significant non- linearities.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0026, DYNAMIC RESPONSE OF BATTLE-DAMAGED STRUCTURES

J. ADACHI, U.S. Army, Materials & Mechanics Res. Ct., *Watertown*, *Massachusetts* 02172 (DA0D4737)

To develop methods and criteria for evaluating reduction in strength caused by combat-incurred damage (projectile penetration, laser exposure, blast-induced rupture, etc.) or the residual load-carrying capacity of structural components, and to devise structural designs which control and minimize the effects of such damage. The ultimate objectives are rational limited-operations envelopes and concepts for fail-safe design of structural components. This effort effects program thrust G-2 'Survivability-Aircraft, Combat Vehicles', and aircraft pacing problem no. 6 - 'Damage Tolerant (Fail-Safe) Design Concepts...'.

A combined mathematical experimental approach examines localized fracture or failure modes and gross failure of structural systems. Metal structural elements, panels and torsion tubes, with various degrees of controlled damage examined for failure mode, failure load, parameter sensitivity and statistical scatter in order to develop a rational, accurate model for battle damage from projectile/laser hits. Statistical considerations are a major factor. The final product will be accurate battle damage modelling procedures and computer codes for predicting structural response and residual load carrying capacity which can be readily applied by survivability-vulnerability groups.

ADDENDA: Supporting agency address is: DARCOM Materials & Mechanics Research Center, Watertown, MA 02172

SUPPORTED BY U.S. Dept. of Defense - Army

1.0027, DEVELOPMENT AND EVALUATION OF AN ADVANCED SIMULATOR FOR THE F111 6883 TEST STATION

G.G. MILLER, Honeywell Incorporated, *Minneapolis, Minnesota* 55413 (DF222200; F33615-76-C-0054)

The purpose of this work unit is to design, develop, and evaluate a prototype simulator to train intermediate-level (I-level) maintenance test station operators and repairmen for the F-111 aircraft. Earlier work accomplished under in-house unit 1121-01-29, Specification and Evaluation of a Simulator for a Converter/Flight Control Test Station, involved the development of a unctional specification, and the completion of projected procurement cost data. This follow-on effort includes the detailed design, fabrication, and test of the specified simulator. The simulator will have direct application in the aerospace ground equipment specialist course, 3ABR326XO, and the integrated avionics component specialist course, 3ABR326X1A, conducted at Lowry AFB, CO. This work unit will address a critical need for more realistic and cost-effective training of test station technicans in these two courses. Demonstration of the feasibility of the approach will have a significant impact on procurement of future training systems above and beyond this specific project.

This effort will be accomplished under contract and will consist of six phases. During phase I the total simulator detail design configuration will be completed based upon government-furnished performance specifications. Cost-benefit and fidelity trade-off decisions will be based upon capability versus cost. In phase II, the simulator will be fabricated based upon design decisions made during phase I. During phase III, an in-plant test will be conducted at the contractor's facility subsequent to simulator fabrication. Phase IV includes delivery of the simulator to the government facility at Lowry AFB, CO, and final acceptance testing will be accomplished in phase V. Instructor and maintenance training will be conducted during phase VI. Prior to completion of this contract effort an in-house work unit will be established and an extensive training test and evaluation will be initiated.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory TTT, Lowry AFB, Colorado 80230

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0028, CHEMICAL STABILIZATION OF SOILS FOR LOC FACILITIES

R.C. EAVES, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (DA0E8185)

Military needs require construction of aggregate and/or select material bases as platforms for pavements, work areas, storage yards, buildings, etc. Military circumstances commonly dictate maximum use of most readily available materials despite poor quality of such materials. It is thus desirable to develop means for the rapid modification (improvement) of the physical characteristics of otherwise too poor quality soils and soil aggregate mixtures permitting their use as supporting platforms (bases) in LOC facilities.

Studies will be conducted to examine the capability of soil additive/chemicals for use in the rapid stabilization of soils for use as airfields, heliports, cantonment areas, storage depots, and beach crossings. Industry will be contacted and materials that have potential will be requested. Laboratory evaluation of materials will be made when submitted. Actual use of material will be made in field application and potential determined. Materials capable of stabilizing plastic soils and soil-aggregate mixtures will be the principal area of research. The secondary area of research will be directed toward chemicals capable of stabilizing sand, either wet or dry, and other near-shore soils.

ADDENDA: Supporting agency address is: OCE Waterways Experiment Station, PO Box 631, Vicksburg, MS 39180

SUPPORTED BY U.S. Dept. of Defense - Army

1.0029, V/STOL - SHIP INTERFACE SYSTEMS

T. GIOIA, U.S. Navy, Engineering Department, *Lakehurst, New Jersey* 08733 (DN696001)

The advent of V/STOL aircraft generated the need to study the problems related to V/STOL operations from aviation and non-aviation ships. Studies will include emergency recovery of V/STOL aircraft, environmental protection of personnel, ship, aircraft, and auxiliary equipment during vertical takeoff and landing, visual landing aid requirements, and interface of these areas with the aviation on non- aviation ship.

Specific element areas will be studied together with ship interface requirements as follows: V/STOL recovery - studies will be conducted to determine methods of recovery of V/STOL aircraft during emergencies when the aircraft cannot land in the normal vertical mode. Studies will include operations during high wind and rough sea conditions; V/STOL related environmental hazards - methods of protecting personnel, ship, aircraft, and equipment will be investigated. Mathematical gas flow models, as well as tests with scale models of v/stol aircraft, porous gratings and other systems will be utilized to establish parameters for design of environmental protection systems. Visual landing aids - studies to establish design parameters for visual landing aids systems for vertical takeoff and landing of V/STOL aircraft on ships will be made.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0030, UNSTEADY LIFTING SURFACE THEORY

J.E. YATES, Aeronautical Res. Associates, *Princeton, New Jersey* 08540 (DN675261; N00014-76-C-0576)

The development of accurate methods for the calculation of unsteady loads on wings is essential for the prediction of their response to gusts, and for the prediction of their aeroelastic behavior. The objective of this research is to extend inviscid unsteady aerodynamic theory to account for 'finite boundary layer and wake effects' in the formulation of a three-dimensional wing theory.

Unsteady analyses for aerodynamic design have been based largely on inviscid linearized theories. For lightly loaded wings such approximations are reasonable and yield results quite useful for design. however, for more highly loaded lifting surfaces whose boundary layers and wakes are much thicker, the neglect of such effects can lead to serious design deficiencies. In the planned research these viscous effects will be modelled within the framework of an inviscid rotational flow. The inviscid shear layer will be used to represent the outer portion of a turbulent boundary layer (the sub-layer will be neglected) and this region will interact with the external unsteady flow. The analysis will be applicable to subsonic flows.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0031, VOLUME PHASE STORAGE OF NAVAL AIRCRAFT NAVIGATIONAL INFORMATION

B. WILLIAMS, David Sarnoff Research Center, *Princeton, New Jersey* 08540 (DN590082; N00019-76-C-0116)

Study and optimize the performance of electro-optic crystals for storage of holographic information. This research will be directed toward applications involving the storage of information for navigational type use by Navy pilots during flight.

The use of crystals of linb03 for phase holographic storage will be investigated. The program will consist of a theoretical and experimental program to identify the ion or ions responsible for fixing the stored information such that it is not destroyed or degraded during read-out. An atomistic model which describes the ionic fixing process will also be developed.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0032, TURBINE ENGINE DIAGNOSTIC DEVELOPMENT

P. PISCOPO, U.S. Navy, Air Propulsion Test Center, *Trenton, New Jersey* 08641 (DN596805)

Demonstrate the feasibility of a diagnostics system which is applicable to current and future Navy aircraft that will: (a) prevent loss of aircraft due to engine-associated causes by monitoring the mechanical aerothermodynamic health of the engine in real time; (b) reduce maintenance time and cost by defining the required maintenance actions down to the line-replaceable-unit (LRU) level.

Develop performance, lubrication system, vibration and hot section diagnostic techniques. Develop and evaluate specialized engine sensors. Develop diagnostic routines capable of identifying engine faults. Apply results of other Army, Navy, and Air Force programs where applicable. Operate diagnostic logic on a full-scale TF30 engine, incorporating faults or simulated faults to demonstrate capabilities of the system under sea level and sea level with RAM conditions.

ADDENDA: Supporting agency address is: Naval Air Systems Command Propulsion Technology Administrator, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0033, HYDRAULIC DIAGNOSTIC AND CONDITION MONITORING SYSTEM FOR MILITARY AIRCRAFT

J. DUZICH, Grumman Corporation, *Bethpage, New York* 11714 (DN781217; N62269-76-C-0195)

Develop a diagnostic and condition monitoring system for military aircraft hydraulic systems.

Conduct exploratory development on a system basis to determine the most effective methods of measuring the operational status of components in military aircraft. Normal and abnormal operating parameters will be defined. This contract is now part of aircraft technology block ZA101.

ADDENDA: Supporting agency address is: NADC Air Vehicle Technology Dept., Warminster PA

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0034, DETERMINE CRITICAL STORE CONFIGURATIONS FOR WING-STORE FLUTTER

J. MARKOWITZ, Grumman Corporation, *Bethpage, New York* 11714 (DN590100; N00019-76-C-0160)

To devise safer and more efficient methods for determining wing- store flutter prevention design criteria. The methods need to be safer in the sense of minimizing the risk of 'missing' flutter critical configurations from the many thousands of store configurations that are often considered, and they need to be more efficient in terms of reducing computer usage and the effective calendar time required to formulate the design requirements.

A design search technique (gradient search will be a candidate) will be formulated and a pilot program developed to determine critical store configurations for wing-store flutter. The search technique will be demonstrated using the intermediate complexity wing with two store stations added and the store support structure modeled as beam elements. Initially the store mass and inertia will be considered as the only variable parameters for each of the store stations with the center of gravity of all stores assumed to be midway between the wing store support points. The envelope for these parameters will be represented as simple rectangles. Double-lattice unsteady aerodynamics will be used in the performance of the design search for the critical stores configuration.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0035, ADVANCED ELECTRONIC FLIGHT CONTROL SYSTEM DEVELOPMENT (INTEGRATED SENSORY SUBSYSTEM)

W.D. WEINSTEIN, Grumman Corporation, *Bethpage, New York* 11714 (DN781227; N62269-75-C-0235)

To develop a fail-operational, combat-survivable, and highly reliable angular rate sensor system for future Navy aircraft. This contract supports work unit ZA101, agency accession no. DN681080.

Advanced skewed sensory electronic triad system in preparation for flight testing in an A-6A aircraft. U design, fabricate and verify the performance of the asset.

ADDENDA: Supporting agency address is: NADC Air Vehicle Technology Dept., Warminster PA

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0036, DEVELOPMENT OF THERMAL SHIELD

C.N. KLAHR, Fundamental Methods Assoc. Inc, *Lawrence, New York* 11559 (DN781212; N62269-75-C-0510)

To develop a thermal shield for occluding heat and light from military aircraft cockpit. This contract is in support of work unit ZA501, agency accession no. DN833223.

A feasibility study has indicated that a liquid-vehicle 'dust wall' will provide the desired end. A contract will be let to provide a small- scale section demonstrating this feasibility.

ADDENDA: Supporting agency address is: NADC Crew Systems Dept., Warminster PA

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0037, ADVANCED FUEL DELIVERY SYSTEM

D.C. GENEVERWATLING, General Electric Company, *Cincinnati, Ohio* 45215 (DN596806; N00140-73-C-0002)

Design, develop, and demonstrate a lightweight, compact, contaminant-resistant, fuel delivery system for use on advanced augmented gas turbine engines.

The overall program has been divided into three distinct phases which will include the following work: (a) Phase I - (12 months) - preliminary system design, dynamic model, starting element development, centrifugal filtration investigation; (b) Phase II - (13 months) - engine fuel delivery system design, and component design, fabrication and bench testing; (c) Phase III - (7 months) - bench testing of a complete fuel delivery and fuel control system and a layout design of flight-weight fuel delivery components.

ADDENDA: Supporting agency address is: Naval Air Propulsion Test Center Research and Technology Group (PE4), Trenton, NJ 08628

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0038, INTERACTIVE USER-ORIENTED AIRCRAFT CONFIGURATION GENERATION

E.C. EDWARDS, Battelle Memorial Institute, *Columbus, Ohio* 43201 (DF136660; F33615-76-C-3047)

Rapid methods for producing new aircraft designs are needed to assure that a large number of alternative designs are considered for the next generation Air Force aircraft. Computers are used extensively for this purpose now but the process is slow since it must be interrupted for input, output and interpretation. The objective of this work is to provide a direct interface between the individual doing the design and the computer and to facilitate interpretation through graphical displays.

The necessary associative and executive interactive graphics computer routines to integrate specified hardware and existing aircraft design software into a unified package will be developed. Emphasis will be placed on the use of data tables and graphics displays for input/output interfacing. Program operations requiring extensive knowledge of computer functioning and languages on the part of the typical user will be eliminated. Remote terminal type graphics system will permit a designer to construct, edit, and display an aircraft configuration data base.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FXBM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0039, DEVELOPMENT OF ADVANCED FLIGHT CONTROL ACTUATION CONCEPTS FOR NAVAL AIRCRAFT

J. DEMARCHI, Rockwell International Corp., *Columbus, Ohio* 43216 (DN781228; N62269-76-C-0201)

The general objective of this task is to examine the broad spectrum of new flight control actuation concepts with respect to

potential advantages and interrelationships with other aircraft systems. The resultant effect of these new concepts will be evaluated against projected aircraft mission and maintenance requirements. Recent advancements in high-pressure hydraulics, onboard computers, electrical power generation and solid-state processing components may offer advantages to new aircraft, especially with growing emphasis on combat survivability and simplified squadron maintenance. The specific objective of this task is to determine the feasibility of constructing a building block (B-B) actuation concept which uses a localized 8000 psi hydraulic power supply and is capable of being controlled electrically. This contract supports work unit ZA101, agency accession no. DN681080.

The contractor initially responded to a NavAirDevCen statement of work soliciting competitively advanced flight control actuation concepts. A feasibility study of a 'building block' (B-B) actuator concept was followed by fabrication of two laboratory-type B-B actuators. This contract is awarded for the production of system components sized and rated for flight testing on the T-2 aircraft. The contract will be funded on an incremental basis over two years.

ADDENDA: Supporting agency address is: NADC Air Vehicle Technology Dept., Warminster PA

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0040, AIRCRAFT ELECTRICAL POWER GENERATION AND DISTRIBUTION RESEARCH

W.U. BORGER, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF458490)

There are three primary objectives: performance of power line transient tests on both VSCF and CSD power systems to substantiate Navy claims of fewer black box failures on VSCF equipped A-4M's, develop a protection system for fighter and smaller aircraft generators by using Hall effect devices for current sensing, and application of the decision-making power of the electrical multiplexing system to the generator protection system, thus negating the necessity of a generator protection panel. This results in weight and volume savings.

The power line transient test will require a definition of an aircraft electrical bus system and the necessary monitoring equipment to record transients. The second objective will be a study of generator feeder protection using Hall effect devices. The decision-making power of the EMUX will be tapped to determine and remove generator system faults.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory POP, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0041, OPERATION OF PARACHUTE DATA BANK FOR WEAPONS SYSTEM DESIGN APPLICATION

J.H. DEWEESE, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF132370)

A significant amount of parachute design and performance data associated with military systems applications has been and is continuing to be generated which does not become available to the technical community due to inadequate data reporting and a lack of any rapid access system for parachute performance data. A parachute data bank has been established to circumvent these problems. The objective of this program is to maintain the currency of the bank of parachute design and performance data and expand the data base through the extraction, analysis and storage of pertinent data and information on gliding and supersonic parachute systems. This expansion of the data base will significantly improve and broaden the services the data bank can render for the expeditious design and performance prediction of parachute systems for emergency crew escape, tactical air drop, weapon deceleration and aerospace vehicle recovery applications.

Previous work efforts have resulted in the data bank achieving an operational status through storage of data on standard subsonic canopy designs. Efforts under this program will concentrate on extracting, reducing and storing data relevant to gliding and supersonic aerodynamic decelerators. In addition, software will be developed to provide required data retrieval formats and manipulation of stored data for purposes of establishing parachute design/performance relationships.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FER, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0042, AUTOMATICALLY EXPELLED LIFE RAFT SYSTEM FOR HELICOPTERS

E. KING, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DN781213; N62269-75-C-0454)

To engineer a working prototype of a CH-46 mounted multiplace life raft system that would be automatically expelled and inflated upon aircraft water ditching. This contract supports work unit ZA501, agency acc. no. DN833223.

Determine the feasibility of securing an externally mounted life raft system to a CH-46. Confirm the significance of introducing such a system in terms of improved survivability. Proceed with system design and development.

ADDENDA: Supporting agency address is: NADC Crew Systems Dept., Warminster, PA

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0043, AIRCREW PERSONNEL PROTECTION, ESCAPE AND SURVIVAL SYSTEMS

D.N. DESIMONE, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974 (DN833230)

To provide naval aircrew personnel with the operational capability to perform aircrew tasks with maximum efficiency, to neutralize the effects of in-flight stresses, and to provide for escape survival and rescue following loss of the aircraft. The following elements support this effort in addition to those listed in item 10 above: P. E. 62241N, P. N. F41-451, P. E. 63216N, P. N. W45-58 and WSL-14, 531000002 and 000000000(O and MN).

The Naval Air Development Center will provide the technical management of the full life cycle of aircrew personnel protection escape and survival systems. The management will include the various phases of RDT and E, acquisition, production, deployment and ILS. Programs will be reviewed, monitored and funded as needed to maintain a continuing flow of progress and milestone achievements. Work is also being performed on contract as reported in work units DS-903B through DS-903B28.

ADDENDA: Supporting agency address is: Naval Air Systems Command Equipment and Support Admin.(340B), Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0044, AIRSHIP TECHNOLOGY, DESIGN, AND APPLICATIONS

J.A. ENEY, U.S. Navy, Air Development Center, *Warminster, Pennsylvania* 18974 (DN581059)

Develop and maintain in-house capability in the engineering design of naval airships, their operating methodologies, economics, and support requirements.

Several technological sub-areas have been selected to be concurrently and complimentarily developed: (1) aerodynamics and aerostatics, (2) flight dynamics (stability and control), (3) structures and materials, and (4) propulsion systems. The full scope of LTA vehicle systems expertise will be developed to reside at NavAirDevCen in a concentrated, integrated form, responsive to conducting and evaluating total LTA vehicle system designs.

ADDENDA: Supporting agency address is: Naval Air Systems Command (03P3), Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0045, DEVELOPMENT OF HIGH-VOLTAGE DIRECT-CURRENT GENERATOR SYSTEM FOR NAVAL AIRCRAFT

R.H. IRELAND, U.S. Navy, Air Development Center, *Warminster, Pennsylvania* 18974 (DN833199)

To develop a high-voltage direct-current electric power system for naval aircraft. Advanced machine design and semiconductor technology will be employed to develop a total power system which will increase system efficiency by at least 10 percent, reduce weight, double the reliability and improve electric

power quality at the utilization equipment terminals. The development of the complete system concept is being continued for advanced aircraft such as the F-14, AV-8, XFV-12, S- 3 and VP aircraft compatibility.

A total system development approach is planned. A brushless dc generator and solid-state regulator control unit will provide raw power, control and protection. A low-induction transmission line will facilitate solid-state switching and help eliminate spurious spikes, transients and EMI. Power conditioners, both dc to dc and dc to ac, will provide isolation and specific power characteristics. Work is also being performed on contract as reported in work units DK302-B3, DK302-B8, DK302-B9, BK302-B10 and BK302-B11.

ADDENDA: Supporting agency address is: Naval Air Systems Command (340D), Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0046, PREDICTION OF LOW-SPEED V/STOL STABILITY AND CONTROL CHARACTERISTICS

C.J. MAZZA, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN581467)

To develop methods to estimate the stability and control parameters and resultant static and dynamic characteristics of total V/STOL vehicles; such methods ultimately applying to several generically different aircraft and fulfilling the requirement for a preliminary design tool capable of analyzing the hover and transition stability and control characteristics of proposed V/STOL designs.

A computerized method for predicting the stability, control and flying qualities of jet-lift V/STOL aircraft is currently in development at the NavAirDevCen. Continued development and refinement is planned. application of the program to the VAK-191B and the joint NASA/Navy lift- fan concepts is planned. Program expansion to include effects peculiar to other types of V/STOL vehicles will be studied.

ADDENDA: Supporting agency address is: Naval Air Systems Command Tech. Admin. (Aero and Structures), Washington, DC

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0047, NAVTOLAND SIMULATION COORDINATION

C.J. MAZZA, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN781089)

To plan, monitor, and perform, as required, all simulation programs related to NAVTOLAND (Navy vertical takeoff and landing) and to insure that requirements for simulator visual, motion, and computer systems imposed by these programs are met.

Assess various concepts advanced by NAVTOLAND support technologies as they impact simulation facility capabilities. Assess existing simulation facilities in terms of these required capabilities. Develop an integrated plan for simulation facility improvement and NAVTOLAND concept evaluations. Adapt recent ship motion and airwake data for simulation application. Develop suitable simulation math models for V/STOL aircraft and NAVTOLAND concepts. Plan and perform specific concept evaluations identified in the overall simulation plan.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Advanced Systems Concepts Division, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0048, STRUCTURAL LOAD DESIGN CRITERIA FOR FUTURE NAVAL AIRCRAFT

F. NEGRO, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN833175)

Develop improved flight and ground loads structural design requirements from operational usage data for incorporation in MIL-8860 specifications, AR-56, and similar documents and assure inclusion of requirements peculiar to Navy and Marine Corps environment. Develop a technique utilizing piloted simulation to predict maneuver load spectra for future naval aircraft. Improved structural reliability and fatigue life for future naval aircraft will result.

Analyze and integrate flight and ground structural load history data compiled on operational aircraft and develop from these data improved structural load requirements reflecting the environment peculiar to Navy and Marine Corps aircraft. Develop a piloted simulation technique for predicting maneuver load spectra and verify the technique with available usage data. Obtain loads data by selectively conducting flight and landing surveys during fleet operations involving new aircraft and missions. Develop recording systems and equipment as required to conduct surveys. Work is being performed on contract as reported in work units DJ502-B, DJ502-B1, DJ502-B2, DJ502-B3, DJ502-B5, DJ502-B6, DJ502-B7 and DJ502-B8.

ADDENDA: Supporting agency address is: Naval Air Systems Command (320B), Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0049, DEVELOPMENT OF AN EVAPORATED METAL STRUCTURAL FATIGUE SENSOR

W.R. SCOTT, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN581135)

Develop improved resistive fatigue gages suitable for use with aircraft structural materials. Such gages will fill an existing need for a small, inexpensive device for monitoring fatigue life and loading history of aircraft structures.

Ordered alloys and other promising materials will be characterized to determine the effect of fatigue on their resistivity. Samples will be in the form of thin sputtered films or rolled foils attached to sheet flexure specimens. Some promising alloys will be fabricated directly in the form of sheet flexure specimens.

ADDENDA: Supporting agency address is: Naval Air Systems Command (320), Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0050, EXTERNAL FUEL TANKS FOR NAVAL AIRCRAFT AND ASSOCIATED COMPONENTS DEVELOPMENT

D.J. ST. JEAN, U.S. Navy, Air Development Center, *Warminster, Pennsylvania* 18974 (DN833211)

To develop a naval aircraft external fuel store that will significantly reduce the hazards and catastrophic effect when impacted by high-velocity projectiles (a tumbled 50 cal bullet has been selected as the simulated threat) and subjected to fire (cook-off JP-4 fire 15 minutes). To design and evaluate new components and materials for use in future external fuel tanks.

Such concepts as (1) filament wound materials in lieu of the aluminum skin; (2) non-metallic materials formed in a sandwich construction or; (3) combination of improved structural materials and sealing liners will be investigated for feasibility of use in tank construction. In addition to reducing the structural damage from high- velocity projectiles, the new concepts must meet certain other parameters such as thermal resistance; aerodynamic considerations such as smoothness and flexibility; static electricity discharge; thermal expansion rates, fatigue and manhandling characteristics. Work is also being performed on contract as reported in work unit DK-604B.

ADDENDA: Supporting agency address is: Naval Air Systems Command Equipment, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0051, ANTI-SEPARATION TAILORED CONTOUR (ATC) TRANSONIC AIRFOIL

C.S. WELLS, Advanced Technology Ctr. Inc., *Dallas, Texas* 75222 (DN581302; N62269-74-C-0517)

To show the feasibility of the ATC (anti-separation tailored contour) concept for applications in the transonic region. The contract supports work unit NN701, agency accession no. DN481077.

Experimentally study the ATC concept by design refinement of a two- dimensional wing section model, by model fabrication, and by transonic wind-tunnel testing for verification of previous theoretical analyses.

ADDENDA: Supporting agency address is: Naval Air Development Center Air Vehicle Technology, Warminster, PA 18974

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0052, V/STOL EJECTOR/AUGMENTOR SHORT DIFFUSER STUDY
C.S. WELLS, Advanced Technology Ctr. Inc., *Dallas, Texas* 75222 (DN681043; N62269-75-C-0317)

The objective of this contract is to investigate boundary layer control as a technique to provide a more compact ejector diffuser design for application to V/STOL aircraft concepts. The contract supports work unit NN701, agency accession no. DN481077.

(1) Utilize existing ejector/augmentor configurations to assess the impact of boundary layer control schemes (tailored contour, diffuser flow injection) on pressure distributions, boundary layers, flow mixing and augmentation ratio; (2) develop design precedures for compact ejector/diffusers including sizing and performance characteristics; (3) design and test a representative augmentor configuration to investigate design procedures and optimization of performance.

ADDENDA: Supporting agency address is: Naval Air Development Center Air Vehical Technology Dept., Warminster, PA

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0053, DETERMINE LOADING BEHAVIOR OF MK7-1 AND MK7-2 ARRESTING GEAR
R.S. EBERS, L T V Aerospace Corporation, *Dallas, Texas* 75222 (DN590025; N00019-75-C-0237)

To correct current information to correspond to the loading behavior derived from airplane test data.

The approach will consist of data gathering and data analysis to establish optimum characteristics for loading behavior of the arresting gear.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0054, AIRCRAFT INSTALLATION OF MULTIPLEXING HARDWARE
W. FIELDS, Boeing Company, *Seattle, Washington* 98108 (DN781192; N62269-76-C-0170)

Obtain transmission system data relative to the operation of GPMS-X terminals when operating with 'live' aircraft system(s) signals. This contract supports work unit ZC201, agency accession no. DN 681082.

Install and operate the NavAirDevCen GPMS-S equipment within the Boeing 720 test bed vehicle. Information pertaining to signal capacity transport delay and will be recorded and analyzed.

ADDENDA: Supporting agency address is: Naval Air Development Center Aero-electronic Tech. Dept., Warminster PA

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0055, LOW-COST GRAPHITE/THERMOPLASTIC PRIMARY STRUCTURE
J.M. LAAKSO, Boeing Company, *Seattle, Washington* 98108 (DN581072; N62269-74-C-0368)

To demonstrate and evaluate the cost savings attainable through design to low manufacturing cost by application of graphite reinforced thermoplastic composites to a representative aircraft primary structural component. This work is in support of work unit ZA101, Aircraft Technology, agency accession no. DN 681080.

The fuselage center section of the BQM-34E supersonic target drone was selected as the primary aircraft structure demonstration component. The redesigned structure will demonstrate the applicability of a graphite reinforced thermoplastic material to a primary airframe structure and enable comparison of the cost and weight with those of the metal structure.

ADDENDA: Supporting agency address is: Naval Air Development Center A, Warminster, PA 18974

SUPPORTED BY U.S. Dept. of Defense - Navy

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, AN ANALYTIC ARTIFICIAL SATELLITE THEORY
K.T. ALFRIEND, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680001)

The long range objective is to develop an accurate analytic artificial satellite theory. The immediate objective is to develop a partial analytic theory using Vinti's theory as an initial approximation in order to evaluate the feasibility of this approach for the development of a full analytic theory. Such a theory could substantially reduce the costs incurred in the orbit prediction and determination of military satellites.

A partial analytic theory which uses Vinti's solution as the initial approximation and which includes some of the zonal and tesseral harmonics, and lunar and solar perturbations will be developed. This theory will then be compared with other theories to determine the best approach for developing a complete analytic theory. The complete analytic theory will then be developed. To develop the theory the initial approximation will be expressed in a suitable set of canonical variables. The perturbing potential will then be expressed in this set of variables and the method of lie series will then be used to develop a solution. All algebraic manipulaion will be performed on the computer using algebraic manipulation routines.

ADDENDA: Supporting agency address is: Naval Research Laboratory (7000), Washington, D. C. 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

2.0002, RADIATION VULNERABILITY AND HARDENING - LINAC
J.C. RITTER, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680017)

The principal long-term technical objective is to perform research in the areas of satellite vulnerability assessment, nuclear survivability, and radiation hardening. This work has important applications to radiation hardening of naval satellite systems.

The approach is to study possible satellite vulnerability mechanisms, and to conceptualize and prove out methods of hardening against them, including mechanisms such as high-atomic-number (z) dose enhancement. Dosimetry research is performed. Efforts to develop dosimetry standardization among testing facilities is carried out as well as improving the NRL LINAC irradiation facility for testing of large-scale integration and other electronic devices.

ADDENDA: Supporting agency address is: Naval Research Laboratory (6000), Washington, D.C. 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, NEW PARACHUTE MATERIALS AND CONSTRUCTION METHODS
J.D. BOONE, U.S. Navy, Aerospace Recovery Facil., *El Centro, California* 92243 (DN937023)

To maintain and improve performance, availability, and reliability of materials and construction techniques of survival, escape, and recovery systems, by R & D of currently used and possible substitute materials. Where consistent with performance requirements, to reduce unit cost, number of supply items, and number of specifications. To support, by materials R & D, the work of other units of the facility where failures, poor service life, or unsatisfactory performance of materials occur. To determine safe or useful life; to determine degree, rate, and, where possible, mechanism of material degradation.

Continuous review of literature, specifications, test methods, and innovations in constructions or materials. Implement laboratory programs where failure of old material, promise of new material, or new service requirements, make acquisition of new knowledge necessary.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0002, AIRBREATHER FUELS RESEARCH

G.W. BURDETTE, U.S. Navy, Weapons Center, *Ridgecrest, California* 93555 (DN682024)

The objectives of this program are: (1) to utilize new hydrocarbon fuels synthesized by Sun Ventures, Inc., Company (under contract F33615- 73-C-2022) in studies related to formulating improved airbreathing missile fuels with higher volumetric net heats of combustion (for increased range), lower viscosities, better storage and compatibility characteristics and lower cost; and (2) to conduct research with these fuels related to use in the liquid propellant gun (LPG).

For ramjet fuel applications, the program approach will be to blend certain sun fuels with existing well-known airbreather fuels such as RJ- 4 or RJ-5, with other sun fuels. These fuel blends will be formulated primarily with specific missiles or missions in mind (e.g., ALRAAM or GORJE). Characterization of the fuel blends will include viscosity/temperature curves, flash point, heat of combustion, long-term storage and a very cursory materials compatibility study (e.g., immersion of bladder samples in fuels). Related to LPG applications, the sun fuels will be studied related to: (1) their reaction rates with various oxidizers, (2) combustion aspects, and (3) general acceptability as LPG fuels.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0003, HIGH-TEMPERATURE PARTICLE EMISSIVITY

M.P. NADLER, U.S. Navy, Weapons Center, *Ridgecrest, California* 93555 (DN682011)

Experiments to determine particle emissivity have been performed for carbon at flame temperatures (5). Also, theoretical predictions have been made for aluminum oxide, magnesium oxide, and carbon (1,2,5). Little data are available for particle emissivities at high temperatures and many uncertainties exist in the theory of particle cloud emissions. The emissions of particles may change dramatically as a function of particle size (1) but little is known about this effect. Predictions of particle emissions and particle/gas cloud radiance has many applications for flares, rocket plumes, flames, and combustion phenomena in general.

Particles of known size distribution will be added to optically thin flames of known temperature distribution. The emission spectra (approximately 2-14 micrometers) will then be examined to determine if the particles emit as graybody and/or at their dipole resonance wavelength(s). Specific regions of the post-flame zone will be observed since temperature gradients are small in the post-flame zone, and sample particle slides will be taken for scanning electron microscope (SEM) analysis to determine the particle size distribution in the region of observation. Particles of Al203 (1,2), SiC(2,3), and SiO2(2,4) will be examined since their dipole resonances are known.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0004, INVESTIGATION OF REINFORCED PLASTICS FOR NAVAL AIRCRAFT ELECTROMAGNETIC WINDOWS

V.A. CHASE, General Dynamics Corporation, *San Diego, California* 92112 (DN590146; N00019-76-C-0405)

Investigation of reinforced plastics for naval aircraft electromagnetic windows. Develop composites for improved performance in aircraft radomes and antenna covers. Work requires experience in the fields of composite materials, particularly in polymer modification, and in electromagnetic window design and fabrication.

Investigate reactive monomers such as triallyl cyanurate for improving the strength and elevated temperature properties of polybutadiene laminates. Develop fabrication processing procedures to obtain maximum properties.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0005, CRYSTAL CHEMISTRY STUDIES

M. SPARKS, Xonics Incorporated, *Van Nuys, California* 91406 (DF900240; F19628-75-C-0123)

AF function - the high powers available in modern lasers place increasingly stringent requirements on optical elements. Materials which will passively transmit large laser powers are needed as windows and optical materials which can withstand high laser intensities (laser hardened) are needed. Deficiency - at present no completely satisfactory material is available for windows in the 3-5 micron or 10.6 micron ranges. There is a need for materials which will protect optical components from incoming laser radiation. Objective - an investigation must be made to determine specific material on classes of materials suitable for laser windows in the infrared. Materials useful in laser hardening applications must be identified. How research contributes - a theoretical crystal chemistry study will identify materials for preparation, growth, and testing at AFCRL for laser window/laser hardening applications.

The approach is a theoretical study utilizing crystal chemistry and optical physics, and an extensive literature search should identify materials with necessary optical properties for above application.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0006, HOT CORROSION AND THE EFFECTS OF NACL AND CARBON

F.S. PETTIT, United Aircraft Corporation, *Hartford, Connecticut* 06118 (DF044380; F44620-76-C-0123)

AF function - the useful lives of nickel-and-cobalt-base alloys and coatings in gas turbine engines are significantly reduced under conditions where salts are ingested into the engine or are present as fuel contaminants. Deficiency - although significant progress has been made of inhibitors in fuel and maintenance washing procedures, no general theory of the initiation stages of hot corrosion exists. Objective - this research seeks to reduce the hot corrosion problem through a thorough understanding of the initiation stage and the effects produced by NaCl and carbon deposition. How work contributes - having a knowledge of the factors which initiate the reactions will enable the rational design of turbine alloys to be made.

Typical turbine alloy and overlay coatings will be heated isothermally or cyclically at 1000 degrees C with and without contaminants. Microstructure, chemistry and structure will be examined to elucidate the initiation mechanisms of sulfidation or acidic fluxing.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE Bldg. 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0007, SPUTTERED ANTI-REFLECTION COATINGS FOR LASER GYROS

H. GRANTHUM, United Technologies Corp., *Hartford, Connecticut* 06108 (DN590151; N00019-76-C-0466)

The objective of this program is to conduct research and development on the possible use of sputtering as a means of providing low-loss, low scatter coatings on windows and mirrors used as critical optical components such as laser gyros.

Experimental and computational work will be performed in order to optimize rf sputtering parameters in the deposition of high-quality, low-reflectivity coatings.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0008, MATERIAL SUPPORT TECHNOLOGY - CHEMICAL ENERGY PARTITIONING
W.A. SANDERS, Catholic University of America, School of Arts & Sciences, *Washington, District of Columbia* 20017 (DN323100; N00014-75-C-0839)

Increased knowledge of the fundamentals of exothermic chemical reactions is of importance to the Navy for material support technology. The particular areas which should benefit from this knowledge include rocket propellants, fuels, explosives, and chemical lasers.

This work will use chemiluminescence techniques to study systematically homologous series of exothermic reactions to determine the vibrational energy content of the products with the aim of determining the reaction features which will lead to efficient transfer to vibrational modes. Attempts will be made to develop a theory, based on experiments, which will allow prediction of vibrational content of the products.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0009, NAVY VEHICLE DESIGN AND CONSTRUCTION - FATIGUE, FRACTURE, AND RELIABILITY OF STRUCTURES AND STRUCTURAL MATERIALS
A.M. FREUDENTHAL, George Washington University, School of Engin. & Appl. Sci., *Washington, District of Columbia* 20037 (DN524912; N00014-75-C-0276)

The pressing requirements for higher structural reliability in aircraft and other high-performance weapon systems makes of vital importance to the military services the development of an adequate understanding of fatigue, and a capability to dependably predict fatigue-based service life. This effort is expected to significantly advance both of these objectives.

Systematic study of relations between microstructure, fatigue performance and reliability in high-strength structural metals and the formation of rules for the production of high-strength alloys of optimal combinations of performance parameters that are relevant to the intended use of the material in the structure. Scanning electron microscope is being used to establish relations of microcrack formation and coalescence.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0010, FRACTURE MECHANICS RESEARCH
D.L. JONES, George Washington University, Graduate School, *Washington, District of Columbia* 20006 (DN590094; N00019-76-C-0151)

Program to obtain an improved understanding of the effects of cyclic loading on the fracture toughness and strength of aircraft structural materials.

Study the relationship between the cyclic load-displacement record and the number of load cycles for several materials.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0011, NAVAL VEHICLE TECHNOLOGY - FUNDAMENTALS OF ADHESION
W.D. BASCOM, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN620102)

To improve the strength and performance of structural adhesives and fiber-reinforced composite materials by improving polymer adhesion to metals and reinforcing fibers. This research is of importance in improving the strength of the composites and adhesives used in naval aircraft and ship construction.

The relationships of chemical composition and structure to the failure micromechanics of polymers stress are being studied experimentally. The investigational techniques include thermorheological and thermomechanical analyses, fracture testing and microscopy.

ADDENDA: Supporting agency address is: Naval Research Laboratory (6000), Washington, D.C. 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0012, IMPROVED POWDERS FOR CERAMIC PROCESSING
P.F. BECHER, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680080)

To produce improved ceramic powders having fine particle size and with minimal contents of both cation and anion impurities. A secondary objective is to achieve improved mixing of multi- constituent powders.

To prepare powders by vaporization of the appropriate metal or metals and reaction of that vapor with the appropriate gas, i.e., oxygen for oxides, nitrogen for nitrides, methane for carbides, and borane for borides. Mixing will be accomplished by simultaneous reaction, or by aerosol mixing, possibly using particle charging. Powders will be collected and processed in a controlled environment, avoiding contamination, to determine the degree of improvement that results in bodies fabricated from such powders.

ADDENDA: Supporting agency address is: Naval Air Systems Command (52032a) Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0013, NAVAL VEHICLES & MATERIAL SUPPORT TECHNOLOGY - RESEARCH ON FACTORS DETERMINING THE PERFORMANCE OF NAVY HIGH STRENGTH STRUCTURAL METALS
E.A. LANGE, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN620113)

New high-strength steels, titanium, and aluminum alloys are required for use in aircraft, submarines, and surface craft of advanced design. Successful fracture-safe design with these metals requires development and standardization of practical characterization test methods for quantitative definition of fracture. The objective of this work is to develop quantitative laboratory methods for characterizing fracture resistance and to develop analysis procedures for predicting structural performance.

Investigations concerning the effects of specimen design impact velocity will be conducted in support of ASTM standardization of the dynamic tear test. Develop improved analysis procedure for defining fracture states of DT temperature transition curves. J-integral fracture characterization procedures will be studied to establish applicability of the method for quantitative definition of elastic-plastic and plastic fracture.

ADDENDA: Supporting agency address is: Naval Research Laboratory (6000), Washington, D.C. 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0014, HIGH-PERFORMANCE COMPOSITES AND ADHESIVES FOR V/STOL AIRCRAFT
L.B. LOCKHART, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680029)

The program objective is to develop high-toughness, high-temperature stable resins for use in graphite-fiber composites and as adhesives in V/STOL aircraft, to characterize these materials for quality control and reliability, and to utilize the materials property data for optimized design of a prototype V/STOL structural element.

Developmental and commercial resins that promise to meet the requirements for V/STOL application will be characterized by spectroscopic and thermomechanical analysis. The mechanical performance and fracture behavior of these resins and of the adhesives and composites fabricated from them will be determined. The data will be used for (a) the design optimization of a V/STOL composite and adhesive- bonded structural element, (b) guidance for further improvements in resins, adhesives and composites, and (c) development of quality control parameters.

ADDENDA: Supporting agency address is: Naval Air Systems Command, (AIR-52032), Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0015, ADVANCED LUBRICANTS
H. RAVNER, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN639148)

To improve present naval aircraft gas turbine lubricants and additives, to provide the reseach efforts needed for development

of advanced lubricants for future higher-temperature aircraft engines, and to ensure compatibility of present and future lubricants with engine components and environments.

The behavior of polyol ester and aromatic ether aircraft turbine oils is studied by laboratory bench tests and then engine environment tests. Materials useful as lubricants are studied to determine their thermal, oxidative and hydrolytic stabilities, and other pertinent properties. Additives to enhance lubricant performance, resistance to environmental stress, and to increase operational life are evaluated.

ADDENDA: Supporting agency address is: Naval Air Propulsion Test Center (PE-72), Trenton, New Jersey 08628

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0016, HYDROGEN EMBRITTLEMENT IN TITANIUM
H.A. ALPERIN, U.S. Navy, Applied Physics Department, *Silver Spring, Maryland* 20910 (DN585158)

To determine parameters relevant to hydrogen embrittlement of Ti using neutron diffraction and scattering methods.

Neutron diffraction will be used to determine the site occupancy of the hydrogen atoms in the alpha and beta phases which are thought to play an important role in the embrittlement process. Quasielastic incoherent scattering by the hydrogen will enable the hydrogen diffusion rate to be determined for all the phases. Measurements will be made from room temperature to approximately 700 degrees C.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Air-52031, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0017, NAVY VEHICLE DESIGN AND CONSTRUCTION - SINGLE POLYMER COMPOSITES OF HIGH TENSILE MODULI
R.S. PORTER, Univ. of Massachusetts, School of Engineering, *Amherst, Massachusetts* 01002 (DN475508; N00014-75-C-0686)

Polymeric materials are used by the Navy in widely varying forms and functions. The properties of such materials are sensitive to the chemical arrangement and physical nature of constituent long-chain molecules. This research is aimed at the preparation and characterization of unique composites consisting of radically different morphologies of a single polymer. Such composites hold the promise of high tensile moduli, but low cost for use in aircraft windows, impact resistant materials and noise, shock and vibration absorbers.

Polymers will be prepared in which a sizable content of continuous (extended chain) polymer crystals are suspended in a 'normal' amorphous polymer of identical chemical composition. Such one-polymer systems will avoid the classic composite problem of failure at interfaces since the composition is chemically continuous. Becuase of a high crystal density for chain packing, high-density polyethylene will be used in initial preparations of one-polymer composites.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0018, FABRICATION OF ENVIRONMENT-RESISTANT COMPOSITES
J.J. GASSNER, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4802)

Fabrication-structure-property relations will be obtained for a wide variety of engineering composites and processing methods. Processing parameters and quality assurance tests will be determined so as to eliminate or minimize environmental degradation during the service lifetimes of Army end items utilizing these materials. Long-term design- allowable data will be generated germane to the service environment to be experienced by the selected end item. Components for aviation systems will be emphasized, due to the markedly improved efficiency (as compared to metals) of lightweight composites in these systems.

Thermosetting and thermoplastic matrices, reinforced with chopped or continuous glass, graphite, or kevlar fibers, will be used in fabricating test specimens by means of a wide variety of processing methods: wet and prepreg filament winding, automatic and manual prepreg layup, injection and compression molding, and sheet calendering. Resulting physical and mechanical properties important in actual service use will be determined before and at various times after exposure to accelerated and actual outdoor weathering. Materials degradation mechanisms will be identified and the information used to develop processing methods for deterioration prevention.

ADDENDA: Supporting agency address is: Darcom Materials & Mechanics Research Center, Watertown, MA 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0019, PREVENTION AND PREDICTION OF ENVIRONMENTAL DETERIORATION OF ORGANIC MATERIALS
R.E. SACHER, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4815)

The goals of this program are to determine and correlate the extent and severity of critical chemical, mechanical and physical property changes in exposed composite materials, in order to provide effective methods of prediction and prevention of environmental deterioration of these materials in Army materiel. Major program thrust - aircraft survivability.

Compounded polyphosphazenes, polyurethanes, coated and uncoated polycarbonates and kevlar, graphite and hybrid fiber composite systems will be simultaneously characterized and subjected to environmental effects at selected field sites, natural and accelerated, and in laboratory apparatus. These systems will be exposed in material, coated, stabilized and stressed configurations to simulate actual field use. Post-exposure deteriorative changes in the materials will be determined by a number of instrumental techniques and mechanical tests developed to follow degradation phenomena. Modes and mechanisms of deterioration will be correlated with critical mechanical and physical property changes in the material. Modified glass fiber reinforced exposed composite systems will be evaluated for environmental resistance. Prevention and prediction data will be generated for these materials for specific applications.

ADDENDA: Supporting agency address is: Darcom Materials & Mechanics Research Center, Watertown, MA 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0020, DEVELOPMENT OF NEW FIRE-RESISTANT POLYMERS
R.E. SINGLER, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4697)

To develop high-strength, chemically resistant, thermally stable polymers with a phosphorus-nitrogen backbone which will be evaluated for use in nonflammable coatings, foams and insulation, hydraulic fluids and greases, adhesives, and other applications. Major thrust - survivability, night operations, aircraft and combat vehicles.

Exploratory synthesis will be continued in the area of poly(aryloxy and arylaminophosphazene) homopolymers and copolymers. Most of the emphasis will be placed on the preparation of copolymers, especially mixed poly(aryloxyarylaminophosphazene) copolymers. The reactions of polyphosphazenes with organometallic agents will be investigated. The thermal mechanical behavior and morphology of these polymers will be investigated in order to determine structure-property relationships for the polyphosphazenes. The study of the mechanism of the phosphonitrilic chloride polymerization will be continued in order to find better routes to these polymers. The large-scale laboratory synthetic effort will be continued in order to provide sufficient quantities of polymers for laboratory processing studies. Polymers will continue to be synthesized for long-term environmental deterioration studies.

ADDENDA: Supporting agency address is: Darcom Materials & Mechanics Research Center, Watertown MA 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0021, NAVY VEHICLE DESIGN AND CONSTRUCTION - RARE-EARTH ADDITIONS TO TITANIUM ALLOYS
B. RATH, McDonnell Douglas Corporation, *St. Louis, Missouri* 63166 (DN675493; N00014-76-C-0626)

Titanium alloys are important structural materials for use in aircraft and ships. Alloy microstructure and mechanical properties can be controlled by effective use of alloying and processing. This research will explore the effects of rare-earth additions to titanium alloys.

Erbium, yttrium and mischmetal will be added to Ti 6-4 and the resulting structure and mechanical properties noted. The role of rare earths as grain refiners, strengtheners, and tougheners will be determined. The effect on TiH2 precipitation will be measured. Variables include composition, fabrication and heat treatment.

ADDEMDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0022, GSE CORROSION CONTROL

W. WOMER, U.S. Navy, Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN696019)

To define the principal and typical corrosion areas in ground support equipment (GSE) as a means of determining the extent and severity of the corrosion problem. To prepare a corrosion control manual (similar to 01-1A-509) oriented specifically to GSE.

Survey 3M data banks for GSE corrosion picture for past two years. Make pictorial field survey of corrosion in operational GSE. Prepare corrosion control manual based on state-of-the-art techniques and corrosion findings.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0023, DEVELOP LUBRICATION CONCEPTS FOR ADVANCED ENGINES

A.J. DORAZIO, U.S. Navy, Air Propulsion Test Center, *Trenton, New Jersey* 08641 (DN596810)

To provide options to the engine designer regarding feasible lubrication systems. The options will list the advantages and limitations of each particular system, the constraints put on the engine design by each system and the degree of follow-on development necessary to make each system optional.

Establish, by review of all available information and follow-on contracts with engine designers, lubricant research laboratories and lubricant suppliers, (a) the 'best estimate' of advanced engine lubrication system requirements and (b) which fluids and systems have the potential of operational status by mid-1980's. Conduct studies designed to assess the relative complexity, feasibility, economy and risk involved in the development of the various fluids and systems. Provide NavAir with well-defined options regarding potential advanced engine lubrication systems.

ADDENDA: Supporting agency address is: Naval Air Systems Command Propulsion Technology Administrator, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0024, NUCLEAR MICROPROBE HYDROGEN DETECTION TECHNIQUE

P. ADLER, Grumman Corporation, *Bethpage, New York* 11714 (DN590052; N00019-75-C-0394)

To provide direct experimental evidence as to whether hydrogen, which is known to play a role in premature brittle failure of high- strength steel and titanium alloys, is also involved in the intergranular failure characteristics of high-strength aluminum alloys under stress-corrosion conditions. Establish hydrogen sensitivity and depth limitations assoicated with interferences from LNM-induced reactions in other elements and establishing LNM detection limits associated with low-level hydrogen concentrations in material surfaces.

Hydrogen depth profile analysis utilizing the lithium nuclear microprobe will be conducted in the vicinity of interfaces, prepared to represent grain boundaries of aluminum alloys, after exposure to sustained loads in a corrosive environment. In addition, preliminary materials analysis experiments will be continued to help elucidate the direction of future materials research efforts related to the influence of hydrogen in brittle fracture.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0025, NAVY VEHICLE DESIGN AND CONSTRUCTION - FLOW AND FATIGUE FRACTURE OF TITANIUM ALLOYS

H. MARGOLIN, Polytechnic Inst. of New York, School of Science & Engin., *Brooklyn, New York* 11201 (DN575245; N00014-75-C-0793)

This research effort will explore the deformation behavior and fatigue fracture of alpha-beta titanium alloys. It will develop needed understanding of microstructural effects in this important class of alloys used in naval structures and jet engines.

The yield and flow behavior of alpha-beta titanium will be examined in a series of Ti-Mn alloys with Mn adjusted to provide 1 to 100 percent beta. Alpha morphology and distribution will be varied and the associated effects on flow behavior noted. Low-cycle fatigue behavior of Ti 6-2-4-6 will be investigated for two strength levels at different sizes of equiaxed alpha and Widmanstatten alpha. Initiation, crack growth and crack path will be determined.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0026, SUPERCONDUCTIVITY IN NONSTOICHIOMETRIC COMPOUNDS

M.J. SIENKO, Cornell University, School of Arts & Sciences, *Ithaca, New York* 14853 (DF037570; AF-AFOSR-2583-74)

AF function - high-temperature superconducting materials are needed for application in airborne multimegawatt power generation and conditioning systems. Opportunity - research specifically directed toward the synthesis and characterization of high-transition-temperature metallic compounds can provide a greater margin of design efficiency and operational reliability than presently available superconductors. Objective - the objective of this research is to study the influence of changes in chemical composition on superconductivity. Approach - the approach is to prepare new compounds that are likely to be superconducting, vary their composition by substitution or departure from stoichiometry, and measure the effect on superconducting critical temperature and critical field. Three kinds of compounds are under study - tunnel structure tungsten bronzes, layer-type transition metal dichalcogenides, metal-atom-cluster compounds. Single crystals are grown by vapor phase transport or rf induction heating. Structural defects and long-range stacking order are being examined.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE Bldg. 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0027, MECHANICAL PROPERTIES OF RAPIDLY HEATED STRUCTURAL MATERIALS

D. BRAUN, U.S. Dept. of Defense, Defense Electron. Supply Ctr., *Dayton, Ohio* 45444 (DN675228; N00014-76-MP-60017)

The objective of this research effort is to survey and compile information on the mechanical properties of Navy and DoD structural materials subjected to rapid heating environments. Definition of additional or needed mechanical properties not available in the literature will also be made so as to guide future research efforts aimed at obtaining such properties.

The Army Defense Electronics Supply Center currently has a contract (DSA 900-75-C-1803) with the Metal and Ceramics Information Center of Battelle Columbus Laboratories, in Columbus, Ohio, under the guidance of Mr. Donald Carmichael, to compile and survey available information on thermal properties of specific materials of interest to DoD. This task will be expanded by means of a MIPR from ONR to the Army, to investigate mechanical properties of interest in naval structural systems, primarily aircraft and missiles, subjected to high thermal/mechanical loads.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0028, DEVELOPMENT OF HIGH-STRENGTH HOMOGENEOUS ALUMINUM ALLOY MATERIALS
H. SULINSKI, U.S. Army, Pitman Dunn Research Labs., *Philadelphia, Pennsylvania* 19137 (DA0B0453)

Improve the properties of high-strength wrought aluminum alloys through improvements in processing techniques, the development of new alloys and a study of recrystallization mechanisms. This work is directed toward solving pacing materials problems in armaments, aircraft, missiles and armored vehicles. RDT & E thrusts are in weapons/munitions and protection.

This program consists of three phases: (1) Ingot processing, (2) alloy development and (3) recrystallization studies. (1) Ingot processing - selected 7000, 6000 and 2000 series alloys will be processed into wrought plate bybusing various TMT procedures and evaluated. (2) Alloy development - 7050-type alloys will be developed. A1-Mg-Li and A1-Mg-Zn-Li alloys will be prepared and evaluated. (3) Recrystallization studies - a wide range of thermal treatments will be applied to 7075 alloy to determine the effects of the morphology and distribution of undissolved precipitate particles on the recrystallization response.

ADDENDA: Supporting agency address is: ARMCON Pitman-Dunn Laboratory, Frankford Arsenal, Philadelphia, PA 19137

SUPPORTED BY U.S. Dept. of Defense - Army

3.0029, POLLUTION CONTROL IN AIRCRAFT MATERIALS
I. CUSTIS, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN581140)

PHASE I. Develop the technology necessary to abate aircraft materials pollution and noise pollution via materials and processes control, design and/or modification. PHASE II. To assist NAVAIR to formulate and maintain in conjunction with other Naval activities an effective and integrated research and technology program in support of the Navy EPP (Environmental Protection Program) as it relates to aircraft weapons systems design, development, testing, operation, maintenance and support. In partnership with the centers involved, to coordinate, review and monitor the execution of assigned research and technology EPP tasks conducted at NAVAIRDEVCEN, NAVAIRENGCEN, NAPTC and the NWC avoiding duplication of effort. PHASE III. Develop the technology to reduce the refuse from packaging materials used in packaging aircraft components and to solve the pollution-disposal problems of plastic sonobuoy packaging materials aboard aircraft carriers and NAS having ASW missions.

PHASE I. The approach will be to survey the materials and material applications used in the field and to evaluate how those materials/applications can be changed to abate pollution and reclaim spent materials. NAVAIRDEVCEN will coordinate and plan in partnership with other naval laboratories a strong research and development program on noise abatement control.

ADDENDA: Supporting agency address is: Naval Air Systems Command (340E), Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0030, ADVANCED ELECTROCHEMICAL & METALLURGICAL TECHNOLOGY - STUDY OF ENVIRONMENTAL STRESS CRACKING OF NAVAL AIRCRAFT ALLOYS
J.J. DELUCCIA, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN848290)

To study stress corrosion and hydrogen embrittlement of high- strength steels and titanium alloys using an integrated mechanistic approach. Determining the effect of hydrogen on the embrittlement of titanium is vital to the use of such material in high-performance aircraft.

The diffusion of embrittling hydrogen in high-strength aircraft alloys is being studied using the electrochemical permeation and metallurgical techniques in various chemical and mechanical environments. A capability to prepare titanium surfaces for subsequent electrochemical treatment has been established using thin-film vacuum techniques. The nature of hydrogen's interaction with titanium alloys is thus being studied.

ADDENDA: Supporting agency address is: Naval Air Development Center (01), Warminster, Pennsylvania 18974

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0031, DEVELOPMENT OF A GALVANIC CORROSION-PREVENTIVE SOLID FILM LUBRICANT
M.K. GABEL, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN581139)

To develop a solid film lubricant with lubrication characteristics equivalent to currently used materials which can also prevent corrosion (including galvanic) between lubricated dissimilar aircraft alloys in a naval aircraft environment. Examples of this type of lubricant application are for fasteners and hinges which now are cost and time- consuming trouble areas on naval aircraft.

The initial theoretical work will be based on the information from the previous ir (reference (b)) to formulate solid film lubricants with corrosion-preventive properties. Two problem areas which must be overcome are the porosity of these materials and the decreased corrosion-preventive properties when the film is burnished. The galvanic corrosion and porosity characteristics will be studied electrochemically. Thermal analysis of these formulations will be made to determine thermal stability and optimum curing temperatures. Friction and wear studies will be made of the final candidate formulations to determine lubrication properties.

ADDENDA: Supporting agency address is: Naval Air Development Center, Warminster, Pennsylvania 18974

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0032, RESEARCH ON CORROSION AND CORROSION-RESISTANT STRUCTURAL AND PROPULSION SYSTEMS MATERIALS
S.J. KETCHAM, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN833088)

Since the overall structural integrity of naval aircraft has a critical dependence on the elimination of catastrophic failures due to corrosion and/or embrittlement, work in this unit involves research on the interactions of environment and stress on high-strength alloys and composite materials as they relate to corrosion susceptibility and propensity to environmental cracking, and on ways to measure and mitigate these factors.

Research is being pursued on the mechanism and detection of microstructural corrosion and environmental cracking of high-strength aluminum alloys by advanced state-of-the-art metallurgical and electrochemical techniques; on the corrosion and stress corrosion behavior of composite materials, both metal fiber/metal matrices and metal fiber/organic matrices.

ADDENDA: Supporting agency address is: Naval Air Systems Command Aerodyn., Struct./Materials Admin. (320), Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0033, DEUTERATION OF FLUIDS FOR NAVAL AIRCRAFT
N. REBUCK, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN933001)

The goal of this program is to provide scientific guidelines for the next generation of aircraft fluids based on deuterium-modified molecules. A more complete definition of deuteration processing will define directional information for new approaches to wide-temperature- range fluids combined with extreme pressure lubricant effects.

Our approach in this investigation involves the exchange of hydrogen atoms in a synthetic fluid with deuterium atoms via a liquid/gas phase transfer mechanism in the presence of a suitable catalyst. The properties of the resultant deuterium-modified fluid are investigated in the fluid state as well as compounded into a grease formulation.

ADDENDA: Supporting agency address is: Naval Air Development Center, Warminster, PA, 18974

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0034, RESEARCH ON REFRACTORY D S EUTECTIC COMPOSITES

M. THOMAS, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN833093)

To identify, produce and characterize new high-melting-point (approx. 3000 deg. F), directionally solidified eutectic alloys which show promise for utilization in 2100-2500 deg. F engine environments.

Optical microscopy will be correlated with data from solidification experiments of candidate high-temperature eutectic systems (2400-3000 F melting point) to select, produce and characterize a eutectic composite having superior strength/oxidation resistance in a 2100-2500 F temperature environment. Refractory metal base (Cb, Cr) alloys will be explored. Ni, Fe, Co base eutectic alloys have been selected for characterization based on the results of a Battelle study sponsored by NavAir.

ADDENDA: Supporting agency address is: Naval Air Systems Command (320), Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0035, ENVIRONMENTAL DEGRADATION 'OF SANDWICH PANELS

R.E. TRABOCCO, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN681033)

To study and mitigate the combined degradation environmental effects of moisture, U.V., temperature, and SO2 on gr/e faced adhesively bonded honeycomb materials.

Gr/e faced honeycomb panels will be subjected to various cumulative and cyclic environmental exposures. Panels will be exposed in the unstressed and stressed conditions that most nearly simulate actual aircraft service conditions. The extent of degradation of these panels will be assessed and methods of mitigation determined. Work will also be performed on contract as reported in work unit DG302B.

ADDENDA: Supporting agency address is: Naval Air Systems Command Tech. Admin. (Aero and Structures), Washington, DC

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0036, DEVELOPMENT OF METAL LAMINATE SYSTEMS

R.D. GOOLSBY, Advanced Technology Ctr. Inc., *Dallas, Texas* 75222 (DN590120; N00019-76-C-0288)

Develop metal laminate systems for air structural applications.

Explore titanium and aluminum laminate combinations bonded by brazing, weld bonding, and explosive bonding.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0037, LASER-INDUCED MOLECULAR SEPARATIONS

A. HERTZBERG, Univ. of Washington, School of Engineering, *Seattle, Washington* 98105 (ENG75-21707)

The research deals with the use of selective photo-excitation as a method of separating chemical constituents, promoting chemical reactions and the separation of various isotopes. A preliminary study of the feasibility of laser-induced separation of krypton from other gases and the results indicate that selective photo-excitation using laser beams may indeed enhance current capability of accomplishing the separation of chemical constituents and isotopes. The research will examine basic laser-plasma chemistry and construct a tunable dye laser source. The behavior of krypton in a gaseous mixture will be a subject of study and definitive experiments will be performed to establish the basis for future work. During the second year the research will extend and modify the techniques into the area of flowing systems and possible chemical or isotope separation. The long-term goal is to develop the required understanding which will lead to the design of efficient and practical chemical or isotope separation systems.

SUPPORTED BY U.S. Natl. Science Foundation

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, AN ANALYTICAL AND NUMERICAL STUDY OF SHOCK WAVE FORMATION

A.R. SEEBASS, Univ. of Arizona, School of Engineering, *Tucson, Arizona* 85721 (DN675087; N00014-76-C-0182)

The ability to predict, accurately, flows with imbedded shock waves is essential for transonic design and optimization. The proposed study will be an analytical and numerical investigation of a nonlinear equation, of the transonic type, to examine the coalescing of waves and the formation of shocks in the interior of the flow.

At very high subsonic speeds a complex flow interaction takes place in the supersonic region imbedded in the flow about the upper surface of an airfoil. Body-generated expansion waves reflect from the sonic line to coalesce and form a shock wave. The nature of this coalescing phenomenon can now be studied only by numerical techniques--techniques which have accuracy limitations, particularly as regards shock location. The purpose of this study will be to attempt to develop an analytical solution which can serve as a basis for improving the presently employed numerical techniques.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0002, PARACHUTE ENERGY ABSORBING DEVICES

G.R. DREW, U.S. Navy, Natl. Parachute Test Range, *El Centro, California* 92243 (DN937025)

To provide fleet aircrew members with devices which will limit the deceleration applied to the human body by existing parachutes mounted upon crew ejection seats. Present parachutes can apply up to 40 g's deceleration. Objective of this development will be to limit decelerations to the 20-25 g range. Recent accident reports cited suspected injury/death caused by unusually high decelerations applied by the parachute. Recent tests have also confirmed that parachute decelerations are a serious hazard for high-speed ejections.

Metal deformation devices, high elongation polymers, and tearing devices were constructed and tested, but all of these systems have encountered technical difficulties and/or undesirable features. In order to retrofit existing parachute/ejection seats, low bulk/weight/cost and adequate EA (energy absorption) are prime requisites. Present effort is centered upon ply-tear webbing, metal or plastic extrusion, and rotary metal deformation as the most promising EA mechanisms. These types of devices are being designed, fabricated, and competitively tested and evaluated.

ADDENDA: Supporting agency address is: Naval Air Systems Command (AIR-340B), Washington, D. C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0003, HOLOGRAPHIC INTERFEROMETRY

D.J. COLLINS, U.S. Navy, Postgraduate School, *Monterey, California* 93941 (DN498062)

Holographic interferometry as a useful engineering technique in complex flow fields is being investigated.

A rapid computer interactive data system has been developed.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0004, TRANSONIC WALL JETS

N. MALMUTH, Rockwell International Corp., *Thousand Oaks, California* 91320 (DN675217; N00014-76-C-0350)

Increased emphasis on propulsive lift devices in advanced naval aircraft has stressed the need for an enhanced understand-

ing of the underlying fluid dynamics processes which control the degree of force augmentation that can be achieved. The planned research will develop a methodology for predicting the flow field about an airfoil containing a transonic wall jet representative of a class of propulsive lift devices.

The interaction of the transonic wall jet with the surrounding flow will be computed for flow fields with increasing degrees of complexity. Initially a jet discharging into ambient air will be treated; viscous effects will be neglected both at the wall and at the outer slip line. Increasing complexity will be added in stages in the form of, first, an external flow and, subsequently, viscous mixing.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0005, THEORETICAL LASER BEAM SENSING

S.F. CLIFFORD, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8AA7 0A 11)

PROJECT OBJECTIVE: Theoretical studies and computer simulations of the use of laser beams for remotely sensing atmospheric parameters, particularly wind, turbulence, and precipitation.

CURRENT YEAR PLAN: Investigate the feasibility of wind and turbulence profiling on ground-to-ground and satellite-to-ground optical paths. Develop the propagation theory in support of our experimental development of new remote-probing methods. Develop the diffraction theory of optical beams through rainfall, in support of development of a laser-beam measuring device.

PROGRESS REPORT: Completed a theoretical study of wind and turbulence profiling, and continued a study of laser-beam propagation through rainfall.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

4.0006, POLYMER TETHERLINE EVALUATION FOR BALLOON TECHNOLOGY

D.L. HAUSAM, U.S. Air Force, Engir. Sci. & Mech. Mtl. Dept., *Colorado Springs, Colorado* 80840 (DF281860)

To tether a balloon and instrumentation package at altitudes greater than 50,000 feet for extended periods of time. To investigate properties and fabrication of kevlar tethered balloon cables. Funded under project order AFCRL Y76-803.

Properties to be investigated include, but are not limited to, cyclic loading effects, long-term static (creep) loading effects, cable break strengths, end termination techniques and cable deterioration in a desert environment.

ADDENDA: Supporting agency address is: Frank J Seiler Research Lab NH, USAF Academy, Colo 80840

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0007, SUPERSONIC FLOW OVER OGIVAL BODIES AT LARGE ANGLES OF ATTACK

H. MCDONALD, United Aircraft Corporation, *Hartford, Connecticut* 06118 (DN590113; N00019-76-C-0314)

The technical objective is to develop a computerized technique capable of predicting the three-dimensional turbulent flow field about sharp-nosed bodies at large angles of attack in supersonic flow.

Current inviscid flow theory and three-dimensional boundary layer theory are inadequate for predicting flow over ogival bodies at large angles of attack. Therefore, a special approach (forward marching computer technique) to solving the flow is required which modifies the coordinate system and boundary conditions, to allow computation of the flow field.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0008, VEHICLE DESIGN AND CONSTRUCTION - ANALYTIC PROCEDURES FOR SYNTHESIS OF NON-LINEAR STOCHASTIC FEEDBACK CONTROL

G. MICHAEL, United Technologies Corp., *Hartford, Connecticut* 06108 (DN675331; N00014-76-C-0710)

The objective of this research is to define, develop, and evaluate analytical synthesis procedures for multivariable feedback control of nonlinear dynamic systems operated upon by random disturbances. Such system capabilities are needed to facilitate the development of aircraft flight control systems for prevention of spin departure during combat maneuvering, improve ability to maintain desired glide slope during carrier landings, precision hover/landing control for Navy V/STOL aircraft, as well as enhanced guidance and control capabilities for tactical missiles.

The approach is based upon separating the stochastic and deterministic aspects of the control problem. This results in a three- part approach to stochastic system control design: (1) deterministic nonlinear feedback control using piecewise-linear/piecewise-optimal (PLPO) procedures, (2) nonlinear stochastic estimator design, and (3) closed-loop control based upon feedback of estimated system state variables through the PLPO control logic. This research is directed towards the development of nonlinear state estimation algorithms characterized by significantly less on-line computational requirements than the extended kalman filter. Four filter approaches will be investigated and evaluated. The most promising will be utilized in a future effort directed towards item (3) above.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0009, RADIATION VULNERABILITY & HARDENING - THEORY

J.B. LANGWORTHY, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680019)

The objective is to calculate the radiation dose absorbed and the resulting damage to electronic and solid-state devices in satellites and missiles caused by radiations from nuclear explosions or charged particle beams. A second objective is to evaluate the vulnerability of present systems to postulated threats and to recommend hardness specifications.

Calculations and computer codes will be developed to determine the energy absorbed and damage resulting from various radiations impinging upon different types of electronic and solid-state devices of interest to the Navy. A correlation will be made with experimental data wherever possible.

ADDENDA: Supporting agency address is: Naval Research Laboratory (6000), Washington, D.C. 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0010, DEVELOPMENT OF P-STATIC INSTRUMENTATION, SPECIFICATION PARAMETERS AND REQUIREMENTS FOR FULL AIRCRAFT P-STATIC TESTS

R.L. TRUAX, Truax Company, *Fort Myers, Florida* 33901 (DN590058; N00019-75-0-0367)

To develop test requirements, instrumentation, and test procedures for full aircraft p-static tests.

Define requirements for measurement techniques, test instrumentation and test parameters for full aircraft electrostatic testing. P3-B aircraft tests positive and negative charging methods will be used in conjunction with Patuxent River high-voltage facility. Recording of produced interference will be made for various charging modes. The most affected equipments shall be singled out for future investigations. A military specification or standard shall be developed including p-static testing procedures and instructions for p-static control. Contractor will work with NATC staff during experiments, tests and in the development of specification/standards. Data and instrumentation developed for p-static draft in contract N00019-75-C- 0105 will be used as applicable.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0011, FLUIDIC INERTIAL GYROS
R.K. BRODERSON, Martin Marietta Corporation, *Orlando, Florida* 32805 (DN590127; N00019-76-C-0362)

The objective of this program is to design and develop advanced fluidic inertial gyros for use in naval aircraft and missiles.

Detailed design, development, and test of both single and two axis fluidic inertial gyros.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0012, WIDE-ANGLE HIGH-RESOLUTION COLOR TV TECHNIQUES FOR TRAINING SYSTEMS
R.B. WEBSTER, U.S. Navy, Electronics & Acoustics Lab., *Orlando, Florida* 32813 (DN694004)

To ultimately develop a wide-angle high-resolution color television visual system for use in training devices. The technology will be applied to visual system(s) requirements for naval pilot training in the 1975-1980 time period, or other visual systems identified as requiring wide-angle high-resolution color. Current color television systems used in Navy training equipment are either medium resolution with small field of view (50 deg) or low resolution with wide fields of view (180 deg). Flight missions such as visual reconnaissance, search and rescue, and air-to-ground weapons of visual display.

This task will be performed in three areas: (1) Requirements: a study will be performed to determine those military missions which require color in the visual display; and the performance parameters required in the simulation to accomplish the task. (2) Hardware: an analysis of existing systems, or those in development, will be performed to matrix concepts to requirements. The remaining parameters will be calculated or identified for a comparison with the state of the art. (3) Deficiencies: those systems components which require improvements, innovation or state-of-the-art advances will be identified. For the proposed study, a proposed visual simulation system consisting of the following components will be considered: (a) optical probe, FOV 180 deg x 90 deg; (b) projection technique, 180 deg x 90 deg; (c) color TV camera, high resolution; (d) TV display, high resolution; (e) 3d model and lighting technique.

ADDENDA: Supporting agency address is: Naval Air Systems Command Instrument and Flight Controls, Washington, D. C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0013, SURVEILLANCE - ION IMPLANTATION OF GALLIUM ARSENIDE
B.G. STREETMAN, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DN675519; N00014-76-C-0806)

Future Navy electronics systems will use solid-state electronics components fabricated in new semiconductor materials. The properties of these materials and their response to various device fabrication processes must be known. The process of ion implantation in gallium arsenide needs clarification if amplifiers, oscillators, and electrooptic devices are to be improved.

The properties of gallium arsenide (GaAs) implanted with various dopant impurities will be studied. Many unknowns will be investigated, such as the effects of radiation damage induced by the ion bombardment, the processes by which the dopant atoms become electrically active in the semiconductor, the effects of various surface encapsulating films which prevent GaAs surface degradation during heat treatment, the determination of the spatial location of impurities before and after annealing (with special attention to enhanced diffusion effects), the correlation of resultant optical and electrical properties with implantation conditions, and the study of impurity and defect centers generated by the processing. Beryllium and sulfur impurity spatial profiles will be determined by use of mass analysis, electron spectroscopy (auger), and the glow discharge optical spectroscopy techniques. Various electrical measurements will be made on samples fabricated into device configurations. Photoluminescence measurements will be used to investigate defect and impurity centers. This task is closely coordinated with other Navy laboratory programs and provides a unique complement to those efforts.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0014, APPLICATION OF AUTOMATED HOLOGRAPHIC INTERFEROMETRY
B.W. HANNAH, U.S. Navy, Aerodynamics Department, *Silver Spring, Maryland* 20910 (DN485311)

The objective of this program is the development of an automated holographic interferometry system of unique measurement capability.

The basic appraoch is threefold. The first involves development and testing of an improved dual-plate holographic interferometry system suitable for wind-tunnel applications. The second is development and application of a unique, automated optical data digitizer capable of automatically transforming the optical images into computer compatible digital data. The third required part is the development and testing of advanced theoretical computer codes needed to apply the above data to quantitative three-dimensional flow fields.

ADDENDA: Supporting agency address is: Naval Air Systems Command AIR-310, Department of the Navy, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0015, MISSILE FLOW FIELDS
F. MOORE, U.S. Navy, Flight Measurements Division, *Silver Spring, Maryland* 20910 (DN685095)

To determine the feasibility of using the earth's electrostatic field to determine roll position on high-speed aircraft. More specifically, to determine the effect of a viscous compressible flow field on the electrostatic field in the vicinity of the body.

The compressible viscous boundary layer equations will be used to model the external flow field. Given this flow field, which to a first approximation is not affected by the emission of ions from the sensor, the electric field and the positive and negative ion density will be determined by finite-element solutions of the governing conservation equations.

ADDENDA: Supporting agency address is: Office of Naval Research, 800 N. Quincy Street, Arlington, VA 22203

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0016, REENTRY VEHICLE BOUNDARY LAYER TRANSITION INDUCED INSTABILITY STUDY
A.M. MORRISON, U.S. Navy, Flight Measurements Division, *Silver Spring, Maryland* 20910 (DN685101)

Boundary layer transition will be studied in a series of ground experiments in order to investigate the source of the anomalous behavior of reentry vehicles in the vicinity of boundary-layer transition as has been exhibited in numerous flight tests.

Static and dynamic wind-tunnel tests will be conducted on scale- model reentry configurations with and without ablating frustra and nosetip. Aerodynamic data will be obtained over a range of Mach numbers, Reynolds numbers, and angle of attack in order to assess the boundary- layer transition - aerodynamic interaction.

ADDENDA: Supporting agency address is: Defense Nuclear Agency, Washington, DC 20362

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0017, CONTROL OF DISTRIBUTED-PARAMETER PROCESSES
J.W. WINGATE, U.S. Navy, Flight Measurements Division, *Silver Spring, Maryland* 20910 (DN585226)

Problems arising in the control of flexible structures and reliable computational algorithms for solving distributed-parameter optimal control problems. In particular, domain-control problems (problems involving moving boundaries).

In the present investigation several approaches will be investigated theoretically to determine which promise to yield effective algorithms. These approaches are: (1) to determine necessary and sufficient conditions for optimality which lead to constructive methods, (2) convert the optimal control problem to a variational inequality and use methods developed for variational inequalities, (3) adapt methods used for solving lumped-parameter control problems.

ADDENDA: Supporting agency address is: Naval Air Systems Command NAIR-310, Jefferson Plaza Number 1, Arlington, VA 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0018, RAMAN GENERATION OF MILLIMETER WAVES IN PLASMAS

C.C. LEIBY, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF900910)

Technical objective - to determine the feasibility of using a recently recognized plasma phenomenon for the generation of coherent millimeter waves. AF function - communications and electromagnetic detection. Deficiency - lack of efficient high-power millimeter wave sources. Objective - experimental verification of a recent AFCRL theory which predicts the possibility of generating meaningful amounts of EM power at millimeter wavelengths. How research contributes - if feasibility is demonstrated, the research will have identified a new and novel mechanism for the generation of millimeter wave power.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0019, COHERENT OPTICAL PROPAGATION AND EMISSION

R.H. PICARD, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF900460)

AF function - communication. Deficiency or opportunity - improved optical signal processing techniques; susceptibility of high-gain laser oscillators to parasitic oscillations. Objective - study coherent optical propagation effects and the physics of high-gain laser media. How research contributes - improve signal processing using coherent optical effects and enable operation of high-gain lasers in noise- amplifier mode.

This work unit is aimed at exploring optical coherence effects in quantum electronic devices and the ways in which they can be used to generate, amplify, modulate, transmit, detect, process, and store optical signals. Optical propagation in resonantly amplifying or attenuating media of pulses short enough so atomic coherence effects are important will be investigated. Such coherent propagation effects are potentially useful in signal processing applications, such as pulse shaping and delay, and in overcoming channel loss for an atmospheric or optical-waveguide channel. In addition, spatial and temporal coherence effects and noise in optical generation, processing, and detection will be studied. One immediate goal of such an analysis is to determine the coherence properties of high-gain lasers operated in a noise-amplifier mode. This mode of operation reduces the susceptibility of high-gain lasers to parasitic oscillations since it employs no resonators.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0020, ATMOSPHERIC ATTENUATION AT MILLIMETER WAVELENGTHS

L.E. TELFORD, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF900380)

AF function - communications. Deficiency or opportunity - current communication frequency bands are heavily allocated and new frequency bands are required for high-data-rate communications channels. Objective - investigate the limitations imposed by the atmosphere on utilization of millimeter wavelengths for communications. How research contributes - determination of atmospheric attenuation, data rate, and reliability for earth-to-space millimeter wavelength communications systems.

Theoretical and experimental studies are conducted to obtain basic knowledge on the effects of the lower atmosphere on millimeter-wave propagation. These effects will be examined for both weak and strong fluctuations of the atmospheric index of refraction. The case of weak fluctuations will be treated by perturbation theory and strong fluctuations by the method of functionals or the theory of radiative transfer. Total atmospheric attenuation at 35 gHz is determined as a function of meteorological conditions and elevation angle from atmospheric emission measurements.

ADDENDA: Supporting agency address is: Rome Air Development Center ETE, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0021, TURBULENCE ENVIRONMENT CHARACTERIZATION

M.G. MILLER, Avco Corporation, *Everett, Massachusetts* 02149 (DF707060; F30602-76-C-0054)

The objective of this program will be to characterize turbulence along the propagation paths of interest at the Arpa Maui Optical Station (AMOS).

The program will include processing of the data from two instruments which measure the atmospheric optical transfer function--the real time atmospheric monitor and the seeing monitor. Results will be compared with theory, estimates of expected degradations will be made and corrective measures will be proposed when feasible. A modified Hartmann device will be used to measure integrated turbulence along the path. Also data from a scintillation sensor, an acoustic sounder and microthermal probes will be analyzed to model turbulence in the vicinity of the site. Significant amounts of computer processing of these data is expected.

ADDENDA: Supporting agency address is: Rome Air Development Center OCS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0022, MANUAL CONTROL - INVESTIGATION OF PILOT PERFORMANCE IN TRACKING CONTROL TASKS UNDER DYNAMIC ENVIRONMENTAL CONDITIONS

J.G. CURTIN, McDonnell Douglas Corporation, *St. Louis, Missouri* 63166 (DN675596; N00014-76-C-0883)

Manual control functions place high demands of attention and workload upon pilots, particularly in single place tactical aircraft. These demands upon the pilot will increase with the advent of CCV (controlled configured vehicle) designs and high-acceleration cockpits. Although stability augmentation techniques, autopilot systems and other concepts have been developed to unburden pilots in performing primary flight tasks, insufficient attention has been given to improve control designs for secondary manual tracking functions (e.g., radar target and navigation tracking). This research is concerned with investigating the potential of alternative control configurations for reducing pilot workload and improving performance in secondary tracking tasks under dynamic environmental conditions.

Advances in applicable design technologies are employed to develop experimental control equipments for systematic investigation in a series of studies in a motion base flight simulator. Tasks for the experiments are derived from an analysis of manual control functions in high- performance tactical aircraft; tasks include concurrent control of the aircraft's flight path, and a secondary set of tasks, such as the acquisition and tracking of targets on a sensor display. Induced environmental conditions being investigated initially are low-frequency random vibrations and accelerations, a regime in which scant data are available for multiple task conditions. Amplitude and exposure time profiles approximate conditions anticipated in advanced tactical aircraft. Subjects are experienced military pilots.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0023, NON-INTEGRATED ENGINE DIAGNOSTIC INSTRUMENTATION SYSTEMS

G. BUCSEK, U.S. Navy, Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN696013)

To effectively develop and/or improve ground support equipment (GSE) for testing, diagnosing, and maintaining propulsion systems in existing naval aircraft, thereby: (1) increasing time between overhauls for present-day engines; (2) increasing maintenance system effectiveness; (3) decreasing skill levels required for utilization of diagnostic systems and equipment.

Contract for a study and analysis to identify most frequent propulsion system failure modes. Contract for a study of commercial and military engine diagnostic capabilities and techniques. Establish liaison with commercial organizations and military agencies involved in the development of diagnostic techniques and equipment. Develop and apply data handling procedures to allow simplified equipment operation and integral decision-making capability. Develop prototype diagnostic equipment utilizing new technology in data handling and state-of-the-art detection and diagnostic techniques.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0024, DEVELOPMENT OF A COMPREHENSIVE NDE (NON-DESTRUCTIVE EVALUATION) EXPLORATORY AND ADVANCED RESEARCH PROGRAM FOR NAVAL AIRCRAFT SYSTEMS

R. CAHALL, U.S. Navy, Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN696012)

To develop a comprehensive program of exploratory (6.2) and advanced (6.3) development for NDE (non-destructive evaluation) of naval aircraft systems.

A review and analysis of the following area will be undertaken to identify high-payoff sectors to which follow-on exploratory and advanced development programs will be addressed. (1) NDE (non-destructive evaluation) technologies, new and/or advanced, shall include but not be limited to: liquid penetrators, ultrasonics, x and n radiography, eddy current, thermal and infrared testing, microwave, magnetics, acoustic emission, holography krypton exposure and oil and fluid analysis. (2) Application and utilization areas, both present and potential. Review of (a) current inspection criteria, (b) scheduled and unscheduled maintenance actions which could be minimized given an adequate NDE technique and (c) fleet feedback concerning current and projected operational NDE requirements. (3) Future requirements, based on aerospace technology projections (new materials and fabrication techniques).

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0025, LAUNCH AND RECOVERY TECHNIQUES FOR FUTURE CARRIERS

T. GIOIA, U.S. Navy, Engineering Department, *Lakehurst, New Jersey* 08733 (DN696002)

To keep pace with post-1975 military developments, the Navy is conducting investigations into the development of high-speed aircraft carriers. A parallel study to investigate problem areas and recommend development of launching and recovery systems compatible with high-wind environment is required to make high-speed carriers operationally successful.

Conduct studies to establish the environmental parameters and related problems that must be resolved for launching and recovery systems operations aboard high-speed carriers. For launcher systems the following must be investigated: configuration of high-speed carriers and related launcher system requirements; projected aircraft that will be used; crew and aircraft protection and flight operation evolutions in high-wind environment; topside and below-deck launcher system configuration and weight, space, and power requirements; auxiliary support systems required. For recovery systems: establish high-speed carrier aircraft recovery requirements; crew and aircraft protection devices; automatic positioning guidance and tie-down of aircraft after recovery; transition effects on the aircraft for high-wind environment to protected hangar area, recovery area arrangement, space, weight, and deck configuration requirements.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0026, NEAR IR LASER FOR IMAGE ENHANCEMENT

R.A. BENDER, Laser Diode Laboratories Inc., *Metuchen, New Jersey* 08840 (DF100590; F33615-75-C-1100)

To develop reliable, high-power, continuous-wave, injection laser for reconnaissance application. Modulation of laser radiation is important for recording and temporal data processing and will be attempted.

To build on the existing GaAs laser diode technology and seek improvements in the areas of thermal contact, heat dissipation, junction formation, layer thickness, device packaging and anti-reflective coatings.

ADDENDA: Supporting agency address is: AF Avionics Laboratory DHO, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0027, DEVELOPMENT OF A LOW-LEVEL ATMOSPHERIC TURBULENCE MODEL

W.S. LEWELLEN, Aeronautical Res. Associates, *Princeton, New Jersey* 08540 (DN590084; N00019-76-C-0142)

Develop a computer model that will take the output from existing operational atmospheric models and predict detailed distributions of wind, temperature, humidity as well as turbulence and turbulent transport in the lower layers of the atmosphere at selected locations and times over the ocean.

An invariant second-order closure model of turbulent shear flow and mass transport has been developed. This model must be generalized (1) by including humidity as a variable and (2) by appropriate coupling to the sea state. Humidity will be treated as a trace constituent which is conserved as it is convected and deferred except for the possibility of condensation (or evaporation).

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0028, BOUNDARY LAYER TRANSITION

F.R. HAMA, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (DN675174; N00014-76-C-0414)

This contributes to the problem of designing efficient hydrodynamics bodies by studying the problem of boundary layer transition. The transition process must be better understood if laminar flow bodies, control surfaces and other concepts utilizing efficient laminar flow over surfaces are to be successful.

A detailed map of the flow field will be determined experimentally at different stages in the transition from laminar to turbulent flow of the boundary layer on a large horizontal flat plate in a low-speed water channel. Transition will be achieved first by internal disturbances and then by external disturbances. These experiments will be supplemented by flow visualization studies. Collection of the data will be followed by suitable analysis and calculations.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0029, HOT METAL IR PREDICTION DEVELOPMENT

F. HUSTED, U.S. Navy, Air Propulsion Test Center, *Trenton, New Jersey* 08641 (DN596807)

Assess the validity of the ir prediction routines, and modify as required, to permit prediction of signatures for current and advanced Navy aircraft engines.

Exercise the computer model, installed during FY 1974, and compare the predicted signature levels with measured data acquired at the NAPTC outdoor field test site. Based upon the extent of the agreement between predicted and measured data, recommend updates to further refine signature predictions capability and the accuracy of the modeling procedures.

ADDENDA: Supporting agency address is: Naval Air Systems Command Propulsion Technology Administrator, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0030, NAVY VEHICLE DESIGN AND CONSTRUCTION - TRANSONIC ANALYSIS OF TWO-ELEMENT AIRFOILS

B. GROSSMAN, Grumman Corporation, *Bethpage, New York* 11714 (DN575295; N00014-75-C-0722)

This research is directed towards developing a completely theoretical solution to the analysis and design of transonic two-element airfoil configuration. The use of such two-element airfoil configurations such as slats has improved performance of combat aircraft at transonic speeds where air-to-air combat usually occurs. However, the reasons for the effectiveness of slats or flaps at transonic speeds are not presently well understood, and good slat or flap designs are experimentally arrived at through expensive wind-tunnel test programs.

A three-phase program is being conducted. In phase I an inviscid transonic analysis involving a merger of conformal mapping with a transonic mixed flow relaxation procedure will be developed. Phase II will develop a viscous flow analysis which will be incorporated into the phase I inviscid transonic analysis program. The latest approach to shock wave-boundary layer interaction and trailing edge interactions will be included. Phase III will apply the above techniques towards developing an effective inverse method to determine airfoil shapes that are shock-free at a given lift coefficient and free stream Mach number. This work unit summary covers phase II.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0031, NON-AVIONIC BUILT-IN-TEST REQUIREMENTS AND CRITERIA

J. KAPPLER, Grumman Corporation, *Bethpage, New York* 11714 (DN590114; N00019-76-C-0313)

The objective of this program is to establish built-in-test requirements and criteria for the detection and isolation of failed components as well as deterioration of operating parameters in non- avionic systems.

The study will commence with a survey of all available maintenance data to indentify non-avionic system components which are causing operational problems. System failure mechanisms and operating parameters will then be determined and the techniques for their measurement will be defined. The analysis will result in the identification of recommended non-avionic parameters to be measured and the definition of requirements/criteria for these parameters to provide the desired fault detection and isolation capability.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0032, PLASMA IONIZATION AND HIGH-FREQUENCY COMMUNICATIONS

R.L. LIBOFF, Cornell University, School of Electrical Engin., *Ithaca, New York* 14850 (DN723250; N00014-76-C-0030)

The objective is to carry out research on plasmas and their interaction with electromagnetic fields. Such interactions are important in that, for example, the application of magnetic fields to moving plasmas provides a means of converting the thermal energy of combustion or fission directly to electrical power without the use of mechanical generators. Further ionization effects in plasmas are important for radio frequency communications and telemetry from space and reentry vehicles. The work is thus of interest to the Navy in communication systems via the ionosphere, power sources, in ballistic missile and atomic weapons effects, satellite surveillance, and in gaseous electronic devices.

Work consists of an examination of the fields excited in a closed cavity by high-velocity particles. The energy in the wake field, namely, the energy which the particle loses to the field it has excited in the cavity, will be calculated. The instability of the beam due to its self- electric field will be investigated and the behavior due to an external magnetic field and due to the ions produced by the beam interacting with the ambient medium will also be considered. The equilibrium of electromagnetic fields in cavities will be studied thermodynamically, kinetically, and electrodynamically.

ADDENDA: Supporting agency address is: Office of Naval Research 421, Arlington, VA. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0033, A FUNDAMENTAL INVESTIGATION OF A HYBRID TECHNIQUE FOR GENERAL U COMMUNICATIONS - ELECTROMAGNETIC SCATTERERS AND ANTENNAS

G.A. THIELE, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DN675287; N00014-76-C-0573)

The results of this program will allow calculation of antenna impedance and radiation patterns from bodies of complex structure such as Navy ships, aircraft, and satellites. It will permit more simplified treatment of slot antennas and conformal arrays of slot antennas such as are used or may be used on high-performance Navy aircraft or missiles. It will enable calculation of radar cross section of bodies with wire or rod appendages such as satellites.

A hybrid technique of determining antenna impedance and radiation pattern will be developed by unifying the method of moments and geometric theory of diffraction. The method of moments technique for calculating the impedance matrix will be extended by separate calculation of the contribution to the matrix elements from the regimes where the method of moments and geometric theory of diffraction respectively apply.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0034, COHERENT LIGHT BEAM DEGRADATION BY HIGH-REYNOLDS-NUMBER TURBULENCE

G.F. CUDAHY, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF132550)

Several new military and civilian scientific flight applications require equipment such as telescopes to operate in flight without the obstruction of a material window. Turbulence in the vicinity of the aircraft causes the light beam to degrade. The objective of this work is to determine the turbulent mechanism causing this degradation and to correlate the turbulence parameters with the beam degradation. This information will be used to reduce the beam degradation.

Experimental tests will be conducted by projecting a light beam through a two-dimensional nozzle-generated turbulent shear layer. The beam degradation will be measured with photo detectors and correlated with turbulence data obtained with hot wire anemometers.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FG, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0035, J-85 AUGMENTOR RESEARCH

K.N. HOPKINS, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF459320)

To provide a J85 engine test-bed capability for use on four other AFAPL in-house research programs: (1) Remote Raman EGT Measurements, 30480570, (2) Alternate Fuels Test, 30480569, (3) Catalytic Ignitor and Flameholder Tests, 30480571, (4) Exhaust Emissions Survey, 30480572.

Set up a J-85-5 augmented turbojet engine in c-stand. Install a cooled emissions sampling probe for use in determining x, y, and z movement capability with a servomechanism in the x-y plane. For the alternate fuel program and the catalytic program, the engine and engine- related equipment will be in place. This program is co-sponsored TB/SF in-house combustion research activity.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory TBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0036, COMBUSTION SYSTEM REMOTE MEASUREMENTS

W.M. ROQUEMORE, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF458220)

The objective of this program is to apply instrumentation which can measure temperature and specie concentration within chemically reactive zones of practical combustion devices.

A sophisticated Raman system to measure exhaust pollutants from an aircraft engine was developed on an AFAPL contract. It is now apparent that this system has many capabilities which can

be utilized for combustion diagnostic purposes. For example, it can determine time- averaged temperature and specie concentration measurements, it has been hardened to operate in the adverse environment of a jet engine, Raman Stokes and anti-Stokes, Mie and Rayleigh scattering and fluorescence can be detected, and point measurements rather than integrated absorption methods can be accomplished. The approach is to apply this Raman system to a variety of different practical combustion problems. System capabilities and limitations will be determined in the following applications: exhaust plane temperature and species mapping, afterburner efficiency measurement, main burner pattern factor measurement, and main burner temperature and species mapping.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory SFF, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0037, SHIP-WAKE TURBULENCE GENERATED BY DE-1052 CLASS DESTROYER ESCORT

UNKNOWN, Boeing Company, *Philadelphia, Pennsylvania* 19142 (DN590069; N00019-75-C-0493)

To investigate the shipwake turbulence generated by DE 1052 class destroyer escort using 1/50 scale model for wind-tunnel testing. The turbulence data will be recorded in a form ready for use on a flight motion simulator for evaluating helicopter/ship dynamic interface.

The contractor will conduct wind-tunnel tests. The tests will be repeated for three different forward speeds to cover the maximum range of ship speeds with head and stern winds. The wind-tunnel test data from the model will be extrapolated to full scale and recorded on multi- channel magnetic tapes ready for use on a flight motion simulator for use in evaluating helicopter/ship dynamic interface.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0038, FEASIBILITY DEMONSTRATION OF A RETARDATION AND AUTOMATIC FLOTATION (RAFT) SYSTEM FOR THE VERTRAP MISSION

T.W. JANSEN, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN681034)

Demonstrate the feasibility of a helicopter installed system designed to provide deceleration during free fall, and subsequent flotation, of a high-value cargo that has been intentionally jettisoned or inadvertently dropped during vertical replenishment operations over water. Automatic deployment of the system is planned to prevent specified levels of damage to the cargo upon impact with the water, to avert sinking and to facilitate recovery by surface ship or helicopter. The system will be readily adaptable to all helicopters which are normally used in the 'VERTRAP' mission. This work supported by work unit PH102B1.

It is planned to study, analyze, design and test equipment to facilitate recovery of a nuclear weapon or other high-value cargo which is separated from a helicopter during vertical replenishment operations over water.

ADDENDA: Supporting agency address is: Naval Air Systems Command Tech. Admin. (Equip. and Support), Washington, DC

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0039, AIR-TO-GROUND WEAPON SYSTEMS COMPONENTS ANALYSIS

J. MIGNOGNA, U.S. Navy, Aero Electronic Tech. Dept., *Warminster, Pennsylvania* 18974 (DN581512)

Conduct engineering investigation in order to establish the airborne radar/weapons control system problem definition that modular designs and concept could be applied for optimum cost-effective solution. Perform engineering analysis of all phases of the problem definition and derive applicable optimum cost-effective solution(s). Review industry programs aimed at defining a Navy modular radar program, monitor and coordinate improvement efforts relative to air-to-air and air-to-ground weapon systems development, test, and evaluation.

Utilize in-house expertise in existing radars/weapons control systems to establish a common problem definition from which optimum solutions could be developed for unique systems. Integrate and exchange our ideas, concepts and philosophies with companies under contract to the Navy for the definition of a Navy modular radar program as applicable to air-to-air and air-to-ground weapon systems.

ADDENDA: Supporting agency address is: Naval Air Systems Command Tech. Admin. (Command Con. and Guid.), Washington, DC

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0040, AVIONICS SEM (STANDARD ELECTRONIC MODEL) DEVELOPMENT

S. PICARD, U.S. Navy, Air Development Center, *Warminster, Pennsylvania* 18974 (DN781232)

To define and develop avionics design requirements for the Navy SEM (standard electronic module) program and to implement and evaluate SEM in selected subsystem ADM/EDM procurements.

The initial effort will be directed towards defining functional commonality and to review and identify subsystems under development to determine applicability to functional commonality. Requirements will be developed and refined to incorporate SEM into recently awarded or contemplated contractual equipment developments which are in the ADM/EDM phase. Guidance and recommendations of avionics environmental usage requirements will be provided in support of the SEM physical/mechanical packaging design and development. Methodology will be developed to incorporate SEM design into all future equipment development and to insure compliance in contractual procurements.

ADDENDA: Supporting agency address is: Naval Air Systems Command Tech. Admin. (Command Con. and Guid.), Washington, DC

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0041, FIBER OPTICS APPLICATION PROGRAM

T.R. TRILLING, U.S. Navy, Aero Electronic Tech. Dept., *Warminster, Pennsylvania* 18974 (DN581510)

To investigate areas and degrees of fiber optics applicability for NavAirDevCen programs (P-3, VFAX, LAMPS), and naval air programs in general.

Contacts will be made with DoD laboratories and industry to identify general areas for fiber optics application in Navy programs. For the primary application areas, a more detailed investigation will be conducted to define areas where fiber optics could be effectively implemented within a reasonable time using the latest fiber optics technology. A report on the feasibility of fiber optics implementation for candidate aircraft system components will be generated.

ADDENDA: Supporting agency address is: Naval Air Development Center, Warminster, PA

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0042, A LASER-DOPPLER VELOCIMETER SYSTEM

A.K. HUSSAIN, Univ. of Houston, School of Engineering, *Houston, Texas* 77004 (ENG76-18714)

This research equipment grant is for a Laser-Doppler Velocity (LDV) System to be used in the Turbulence and Aerodynamics Laboratory of the Cullen College of Engineering at the University of Houston.

The LDV system will be used on current and future research projects such as turbulent mixing, which is important to the understanding and control of water and air pollution, jet noise generation, and a number of hydrodynamic, chemical and biological processes.

SUPPORTED BY U.S. Natl. Science Foundation

4.0043, THE NUMERICAL STUDY OF TURBULENT FLOWS

S.A. ORSZAG, Flow Research Incorporated, *Kent, Washington* 98031 (DN223449; N00014-72-C-0355)

An understanding of turbulent flow and transition from laminar to turbulent flow is central to the development of a design methodology for predicting viscous phenomena associated with aircraft, missiles and ships. The present research is a numerical study of turbulence and transition, within the framework of the Navier-Stokes equations, to assess the accuracy of commonly used turbulence closure models, and to develop a better understanding of laminar instability and transition to turbulent flow.

An accurate prediction of turbulent flow and the transition of laminar flows to turbulent flows, without arbitrary transport assumption (closure conditions), would represent a major advance in our understanding of such phenomena and our ability to incorporate such information in naval systems design. In the present research, the Navier-Stokes equations will be solved numerically by a spectral method without closure assumptions for a class of basic problems. To assess the validity of closure models, these calculated results will then be used to verify the validity of the assumed relationships between the mean flow properties and the time-averaged properties in the closure models. The study of transition will compare the numerical predictions with a carefully controlled set of experiments for flat plate flows. The numerics will then be extended to pipe flow transition problems which have defied theoretical understanding.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0044, ELECTROMAGNETIC CHARACTERISTICS OF COMPOSITE AEROSPACE STRUCTURES UNDER NORMAL & DISTURBED OPERATIONAL ELECTROMAGNETIC AMBIENTS

J.E. BROWN, Boeing Company, *Seattle, Washington* 98108 (DN590170; N0019-76-C-0497)

The objective of this program is to develop qualitative criteria for the design and protection of composite structures to support the electromagnetic and related requirements of air vehicles and their associated avionics/electrical equipments.

The contractor will start experimentation, development, and fabrication of advanced composite structure samples, where none are available. Present and future composites such as boron, graphite and fiber glass composites will be considered. Exploratory development will be used to determine significant electromagnetic properties of composites. The investigation will cover electromagnetic parameters to support present and future avionic systems in composite aerospace vehicles. Instrumentation, test requirements, operation requirements and procurement/design documentation will form part of the output of this program.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0045, TRANSONIC VEHICLE DESIGN - THEORETICAL STUDIES OF TRANSONIC FAR-FIELD AND NEAR-FIELD MATCHING

P.E. RUBBERT, Boeing Company, *Seattle, Washington* 98108 (DN675586; N00014-76-C-0931)

The development of accurate methods for predicting the transonic flow field about complex naval aircraft and missiles is essential for their design and optimization. The proposed research will explore new methods for matching analytical far fields with numerical near fields to describe the inviscid flow about complex configurations.

In the computation of transonic flow fields about bodies by numerical means, the calculation region must be finite and limited to extent, yet the field of interest is usually infinite. If coordinate transformations are not convenient, such as in complex three-dimensional flows, or if the size of the numerical field must be restricted because of the magnitude of the computations, a common procedure has been to match a numerical near field calculation to an analytical far field. The closer the matching contour the greater the savings in computation. The proposed research will examine matching in which continuity of both the velocity potential and its normal derivative are preserved as well as the use of higher order far field solutions.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, NAVY ENVIRONMENT - SOLAR AND TERRESTRIAL RADIATION FLUXES OVER ARCTIC PACK ICE

K.O. JAYAWEERA, Univ. of Alaska, Geophysical Institute, *Fairbanks, Alaska* 99701 (DN675270; N00014-76-C-0443)

The understanding of the large-scale response of sea ice to its environment is a goal of AIDJEX (Arctic Ice Dynamics Joint Experiment) and of Navy research. Many important practical and theroetical problems, ranging from the passage of ships to global climate, are involved in AIDJEX. Ice dynamics to be comprehensive must relate the thermodynamic behavior of sea-ice to mechanical behavior initiated by air and water stresses. A complete radiation study is an integral part of evaluating thermodynamic behavior.

Aircraft and satellite data will be compared to obtain large-scale cloud conditions and the effect of stratus on the radiation regime. Contouring the temperature and hence the emitted longwave radiation from the region of the Beaufort and Chukchi Seas will be done on a continuous basis from satellite imagery. These data will be used to calculate the effect of arctic clouds on the outgoing infrared radiation.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0002, LIGHTNING MEASUREMENTS

E.P. KRIDER, Univ. of Arizona, Inst. of Atmospheric Physics, *Tucson, Arizona* 85721 (DN223081; N00014-76-C-0206)

In collaboration with contract N00014-75-C-0143 at Florida State, the aim of this research is to calculate the channel current and propagation speed of return lightning strokes from measured values of the associated electric and magnetic fields and to compare calculated speeds with those observed on newly developed equipment. Naval relevance of this research is improved safety of flight and better design of equipment subject to interference by lightning transients.

Photoelectric detectors will view four different vertical sections of a channel, and the time delay between the first appearance of luminosity at each of the four heights will provide the velocity as a function of height. This observed velocity will be compared with that from measured values of the electric and magnetic fields.

ADDENDA: Supporting agency address is: Office of Naval Research 412, Arlington, VA. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0003, MEASURING OZONE IN AIR

R. SCHOTLAND, Univ. of Arizona, Inst. of Atmospheric Physics, *Tucson, Arizona* 85721 (DN575147; N00014-75-C-0740)

In the interests of environmental support of naval weaponry, the objective of this research is to remotely sense in close to real time atmospheric constituents and properties that detrimentally affect the guidance systems of naval weapons.

The initial attempt at remote sensing under this renewal will be for ozone by using a lidar frequency of 3050 Angstroms and a spectroscopic absorption technique.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0004, EQUATORIAL SCINTILLATION STUDIES

L. DOSSANTOS, Fed. Univ. Do Rio Grande Norte, *Natal, Rio Grande Do Norte, Brazil* (DF243660; AF-AFOSR-2752-75)

AF function - communications. Deficiency - communications outages, radar errors and false targets. Objective - to provide ob-

servational data of ionospheric deep fading parameters at magnetic equator. How research contributes - results used in statistical models of fading depth and occurrence. This work starts observations of transmitting satellites from a new station on the magnetic equator. The fading depths and rate are measured and statistical distributions are computed. This work furnishes a point of observation almost midway in longitude between Huancayo, Peru and Accra, Ghana, where similar studies show highly different behavior. The results are disseminated to communications designers and planners.

The approach is to record, reduce and analyze uhf radio signals from transmitting satellites in order to determine disruption caused by the equatorial ionosphere.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH L G Hanscom AFB, Bedford, Mass 01730; Performing organization: Universidade Federal do Rio Grande, Norte Natal, Brazil.

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0005, COMMUNICATIONS - QUANTITATIVE GLOBAL MODEL OF IONOSPHERIC ELECTRON DENSITY

W.P. OLSON, McDonnell Douglas Astro. Corp., *Huntington Beach, California* 92647 (DN575349; N00014-75-C-0821)

Naval communications, navigation and surveillance systems utilizing the long-range propagation of electromagnetic waves require a predictive capability of the condition of the ionosphere. Ionization distribution in the ionosphere controls the long-range propagation of these signals. In order to attain this predictive capability a specification is required of ionospheric electron density.

A quantitative model, global in extent, will be developed to predict ionospheric electron density using monitored data from ground stations and satellite systems such as SOLRAD and DSMP. Solar electromagnetic fluxes, fluxes of charged particles into the ionosphere, will be used to input this model.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0006, OBSERVATION, ANALYSIS AND PREDICTION OF MARINE FOG

D.F. LEIPPER, U.S. Navy, Postgraduate School, *Monterey, California* 93941 (DN498070)

To cooperate with Calspan, Inc., in observing and describing the formation and dissipation of fog at sea; to relate synoptic-scale variables in meteorology and oceanography important in marine fog to microphysical characteristics; to improve the accuracy and utility of marine fog forecasts.

Observations of meteorological and oceanographic parameters significant to fog development and dissipation will be made at sea using NPS ocean research vessel Acania. These will be related to synoptic- scale analyses for the atmosphere and ocean. Predictions for marine fog situations will be made using existing techniques; improved forecasting models will be developed based on observations and analyses above.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D. C.

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0007, NAVY ENVIRONMENT - RADAR OCEANOGRAPHY

A.M. PETERSON, Stanford University, Center For Radar Astronomy, *Palo Alto, California* 94305 (DN475160; N00014-75-C-0356)

Fleet activities involving carrier and ASW operations depend upon a capability to forecast surface winds, wave conditions, and acoustic propagation conditions in the upper ocean. In order to improve this capability, it is necessary to look at basic phenomena near the air-sea interface such as the generation of waves and currents by wind and the deepening of the mixed layer (thereby affecting acoustic propagation conditions) by the combined influence of waves, currents, and wind. The objective of this project is to evaluate the potential for using radar for remote sensing of surface winds, ocean waves, and currents.

Both direct path and over-the-horizon radars will be used to gather data concerning the nature of radar signals backscattered from the sea surface. Independent measurements of surface winds, waves, and currents will be taken, for use in comparison with the radar backscatter. In addition, theoretical studies will be conducted to relate the nature of radar backscatter to the conditions at the ocean surface.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0008, ENVIRONMENTAL ASSESSMENT

J.M. GOODMAN, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680316)

The objective of this work unit is to analyze SOLRAD-HI data with a view toward developing an association between solar observables and various ionospheric effects of importance to Navy systems. Ultimately this research will lead to either new or improved ionospheric forecasting capability. This capability will, in turn, lead to exploitation potential. The development of associations will be made as quantitative as possible with the determination of algorithms given priority attention.

SOLRAD-HI data will be obtained at the NRL Satellite Tracking Station and transmitted to the SEDAC (Space Environment Data Analysis Facility) at NRL for processing. Geophysical data is transmitted to the SEDAC over teletype (ATN). Fleet communication outage data will be provided by COMNAVETELCOM by message or telephoto copy. Plans are being made to transmit the rf data (faraday rotation and amplitude scintillation) to the SEDAC over phone line from CBD and Blossom Point.

ADDENDA: Supporting agency address is: Naval Reseach Laboratory (7000), 4555 Overlook Ave., Washington, D. C. 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0009, METEOROLOGICAL PROCESSES (CLOUD AND FOG PHYSICS)

W.A. HOPPEL, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN639119)

Provide new and improved capabilities to the Navy in its functions of predicting and modifying fog and rainfall. Achieve a better understanding of cloud and fog dynamics, glaciation, condensation processes, electrification, and the role of cloud condensation nuclei (CCN) in clouds and marine fog and their effects on naval operations.

Theoretical modeling, laboratory studies, and field experiments are used to determine the characteristics of natural and artificially modified clouds and fog and artificially modified clouds and fog, to identify promising areas of new research, and to develop physical principles for the design of new instruments, some of which are developed within 6.2 work units.

ADDENDA: Supporting agency address is: Naval Air Systems Command (NAVAIR 370), Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0010, REMOTE OCEAN SUBSURFACE TEMPERATURE PROFILER (ROSTEP)

V.E. NOBLE, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680319)

To determine the feasibility of remotely measuring open ocean subsurface temperature profiles. These measurements will provide quantitative data on air - sea energy exchanges which support meteorological and oceanographic prediction models and also as inputs for sound velocity calculations to predict performance of tactical and strategic acoustics weapons systems. The fundamental problem is to develop a remote sensing capability that measures temperatures below the surface of the ocean.

Utilizing the fact that the Raman spectrum centroid shifts with the temperature of the medium, conduct a system analysis for establishing system parameters of a model laser sensor in the visible region for operational measurement of subsurface ocean temperature profiles. Utilize data from field measurements with

the feasibility model sensor to define performance parameters for operational systems to meet Navy measurement requirements.

ADDENDA: Supporting agency address is: Naval Air Systems Command (AIR 370C1), Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0011, IR METEOROLOGY

L.H. RUHNKE, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN680235)

Determine the effects of atmospheric aerosols, water vapor, and other meteorological factors on the modification of the ir signature of hot targets by the intervening atmosphere.

Provide meteorological support for high-resolution atmospheric measurements over an ocean path. Provide calibrated instruments and measure atmospheric aerosols, sea salt, water vapor and other meteorological factors simultaneously with resolution optical transmission measurements. The NRL jack-up barge is planned to provide mid-path data on vertical gradients of temperature and humidity.

ADDENDA: Supporting agency address is: Naval Weapons Center (39403), China Lake, Ca. 93555

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0012, HF RADAR SPECTRAL ANALYSIS FOR REMOTE SEA SENSING

D.B. TRIZNA, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN580094)

The aim is to develop techniques for the extraction of oceanographic and meteorological parameters from Doppler power spectra of hf radar energy backscattered from the sea. These techniques will be applied toward remote sensing operations of an over-the-horizon hf radar collecting data from cells contained in ocean areas over millions of square miles. Naval ship routing activities are regular users of such data, which are presently reported by ships at sea, a technique which tends to leave large areas unreported on. Both surface and subsurface naval operations can be severely restricted by lack of data from such areas. Thus, comprehensive real-time knowledge of ocean waves is essential for the intelligent application of naval forces.

Use sea echo radar on San Clemente Island to collect and analyze high azimuthal resolution data (2 deg) in the surface wave mode to investigate Doppler spectrum of statistical variations with azimuth and radar frequency. These are useful for knowledge of the statistics of the sea surface as a function of sea state, as well as for comparison with ionospheric target fading statistics.

ADDENDA: Supporting agency address is: Naval Research Laboratory (5000), Washington, D.C. 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0013, NAVY ENVIRONMENT - AIRCRAFT MEASUREMENTS OF THE UPPER OCEAN THERMAL STRUCTURE

A. CARR, Nova University, Physical Oceanographic Lab., *Dania, Florida* 33004 (DN575384; N00014-75-C-0165)

In order to increase the Navy's capability to predict sound propagation conditions in the upper ocean, which is vital to the successful operation of surveillance and ship sonar systems, it is essential to improve our capability to monitor the upper ocean thermal structure. The objective of this project is to develop an airborne expendable bathythermograph which is better (more accurate and deeper sensing) than the present SSQ-36 (Naval AXBT).

The contractor will take the commercial Sippican 750-m-deep XBT (which itself is in wide use in the fleet) and incorporate it into a package with telemetry compatible with standard systems on board naval aircraft. This AXBT, coupled with a better recording system under development at Fleet Numerical Weather Central, will then be used routinely for monitoring the upper ocean thermal structure in both the MODE and NORPAX programs, using naval aircraft-of-opportunity.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0014, TURBULENCE MEASUREMENTS IN MARINE FOG

J.B. RUSSELL, U.S. Navy, Avionics Facility, *Indianapolis, Indiana* 46218 (DN597002)

To determine the nature of the turbulent regime associated with fog at sea.

To participate in sea cruises to collect turbulence data using hot wire anemometer, cold wire thermometer, etc., to evaluate these various sensors according to their ability to measure turbulent fluctuations of atmospheric parameters in a marine fog environment. To reduce the data collected and present them in a format appropriate for interpretation and modeling.

ADDENDA: Supporting agency address is: Naval Air Systems Command (AIR-370C), Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0015, NAVY ENVIRONMENT - FLUORESCENT MATTER IN COASTAL AND OCEANIC REGIONS

G.D. HICKMAN, Applied Science Technol. Inc., *Germantown, Maryland* 20767 (DN675375; N00014-76-C-0711)

This study is to provide background information on fluorescent matter in coastal zones and the oceans in general. The remote sensing of physical characteristics of coastal waters such as currents, eddies, sediment transport, temperature, salinity, sound propagation, electromagnetic penetration, etc., cannot be fully evaluated without first considering techniques using the fluorescence of certain materials that can be used as indicators for the characteristics. All the quoted physical parameters are of interest to the Navy and Marine Corps.

A large number of specific studies on oceanic fluorescence has been undertaken and the theory thoroughly investigated, but no in-depth compilation on the actual occurrence of fluorescent matter seems to exist. The principal investigator will make literature search and conduct discussions to compile information on the horizontal, vertical, and temporal distribution of fluorescent matter in coastal and shallow water regions. The study will include information on the general oceanic distribution as well. The final product of this study will be contour maps and/or digitally taped data on the distribution of this material to be used for the evaluation of coastal remote sensing methods.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0016, AIRBORNE MULTI-SENSOR COASTAL RECONNAISSANCE SYSTEM

G.D. HICKMAN, Applied Science Technol. Inc., *Germantown, Maryland* 20767 (DN675693; N00014-76-C-1042)

The objective of this project is to make a technical assessment of the current state-of-the-art and availability of remote sensors, the sensors' compatibility, and their compatibility relative to signal processors and display systems for a recommended airborne reconnaissance system.

A literature search will be made of system components to include imaging and non-imaging sensors, microcomputers, and communications systems. On-site reviews of sensor systems, signal processors and display systems in aircraft and ground stations will be conducted. Characteristics of the various sensor and data systems will then be analyzed and equipment performance and interface problems recognized. Recommendations will then be advanced for a basic compatible coastal reconnaissance system.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0017, VERTICAL TEMPERATURE WATER AND WIND PROFILING

V.J. FALCONE, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF243810)

AF function - weather forecasting, weapons delivery, surveillance. Deficiency - inability to determine meteorological conditions over inaccessible or unfriendly territory. Objective - to

develop techniques to better utilize present vertical probing capability of meteorological satellites and to recommend new and/or refined sensors. How development contributes - improves the ability to analyze and forecast atmospheric parameters of importance to military operations.

Data collected by both the military and civilian satellites will be compared with standard meteorological data collected simultaneously at subsatellite positions. Two independent information retrieval techniques will be employed to determine which gives the better agreement with the standard meteorological data. This will achieve the goal of determining the relative information content and usefulness of satellite measurements as well as indicate sensors which should be modified and/or developed.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LY L G Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0018, OBJECTIVE VISIBILITY FORECASTING TECHNIQUES

W.S. HERING, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF243910)

AF function - launch and recovery of military aircraft. Deficiency - inadequacy of present short-range forecasts of airfield visibility. Objective - develop and evaluate objective visibility forecasting techniques using space-time correlation and translation vector concepts applied to automated observations from a dense network of stations near the airfield. How development contributes - the launch and recovery of military aircraft can be made more effective and less hazardous when adequate warnings of low-visibility conditions are forecast.

Objective forecast aids are necessary to rapidly screen the vast amount of data generated by the mesonetwork in order for the forecaster to be able to predict rapid changes in a timely and efficient manner. Data gathered from the mesonetwork will be thoroughly analyzed to reveal space-time correlations, pattern translation vectors, and other derived quantities which prove to be effective predictors. Objective forecast techniques will be formulated with output in probabilistic terms and tested on independent data.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LY, L G Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0019, RESOURCE MANAGEMENT APPLICATION OF REMOTE SENSING

M.P. MEYER, Univ. of Minnesota, Agric. Experiment Station, *St. Paul, Minnesota* 55101 (0023512; MIN-19-037)

OBJECTIVE: Improve and extend the capabilities of managers of vegetation, animal, soil, water and human resources.

APPROACH: Research of this type is, to some extent, unique in that it lends itself well to short-term development. Planning often takes longer than actual execution of the information-gathering portion of the project. Usually ground truth must be gathered at, or near, the time of overflight. From that point, results may be obtained rather quickly in that the desired phenomena are either visible, available and useful--or they are not. Most remote sensing studies follow the following, approximate, format: Definition of the problem; design of equipment-vegetation stage (if involved)-film/filter/time-overflight-ground truth- analysis package; overflight(s) and (sometimes) simultaneous gathering of ground truth; image interpretation; data analysis; report and publication.

PROGRESS: A portable field viewer for 9 X 9 CIR transparencies was developed and tested by USDA-SCS field personnel. Continuing tests of 35mm aerial photography for waterfowl census suggest CIR at 1:8,000 or larger will be adequate to identify snow, blue and Canada geese. An analysis of current and past 1939-1974 aerial photography and past treatments of a large portion of the Superior National Forest is being completed and related to the status of certain wildlife populations. Successful pilot tests were made of CIR 35mm aerial photography for survey of dwarf mistletoe in black spruce and sale preparation and management of these infected stands. Fall 35mm aerial photography proved economical and highly useful in the inventory of maturing pine plantations and the formulation of treatment plans including mechanical harvest scheme design. Similar photography was successfully tested as a means of identifying and classifying paper birch stands for intensive management. A remote sensing applications work plan and operational manual for the Minnesota DNR is in progress.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0020, ATMOSPHERIC CHEMISTRY

V. MOHNEN, State University of New York, School of Arts & Sciences, *Albany, New York* 12222 (DN923067; N00014-75-C-0283)

The investigation of atmospheric ozone anomalies of very high concentration and what association these anomalies might have with anomalies in the ion or dust concentrations is the objective of this research. The information to be developed, the role of ozone in aerosol formation, is relevant to the operation of Navy electrooptic systems.

To obtain the necessary field data the principal investigator has access to the flight deck of scheduled commerical aircraft. From this he can monitor ozone, ion, and dust concentrations during both day and night flights.

ADDENDA: Supporting agency address is: Office of Naval Research 412, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0021, RAPID MAPPING OF LAND USE BASED ON REMOTE SENSED DATA

F.Y. BORDEN, Penn. State University, Agric. Experiment Station, *University Park, Pennsylvania* 16802 (0059566; PEN01931)

OBJECTIVE: Develop a system of rapid classification and mapping of land use based on aerial photographic and multispectral remote sensed information.

APPROACH: Using computers and other specialized automatic image analysis equipment, aerial photographs, multispectral imagery and digitized imagery, data will be analyzed by multivariate statistical methods and by machine-researcher interactive means to produce map displays of land-use patterns such as forest types, agricultural and non-agricultural open land as two of many examples.

PROGRESS: The system for processing multispectral scanner (MSS) remote sensor data has been extended to perform a variety of transformations and formattings. These features have been implemented to allow display of classification results in color using a computer printer, a color television monitor, or a color film recorder. Interpretation of results has been much improved by using color displays. Transformations for geometric correction and scaling of LANDSAT data have been developed which have led to the production of maps and map overlays in 1:24,000 scale. Canonical analysis has produced transformation matrices which have resulted in the preservation of the majority of discriminatory information in three transformed variables. Using three canonically transformed variables has allowed color map displays to be produced which show the discriminatory information. Interpretability has been significantly improved compared to color displays of three MSS raw data variables. The MSS data processing system composed of integrated programs is available for installation on IBMs/367 or IBMs/370 medium to large computers. The system has been installed on seven United States and foreign computers.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0022, INTERMEDIATE PHOTOMETRIC CLASSIFICATION OF AFGL INFRARED SURVEY SOURCES

R.D. GEHRZ, Univ. of Wyoming, School of Arts & Sciences, *Laramie, Wyoming* 82071 (DF248010; F19628-76-C-0271)

AF function - target detection, discrimation, early warning, acquisition and terminal guidance. Deficiency - the capability of infrared sensors to acquire, detect and track targets against the natural background is significantly affected by the character of the spectral distribution of energy from the background objects. Objective - to obtain intermediate spectral bandpass measurements of a significant number of sources in the AFCRL Infrared Sky Survey Catalog. How research contributes - these measure-

ments will provide low-resolution photometric spectral information from 2.2 microns to 25 microns on a significant number of AFCRL survey sources. These data will permit sorting the sources into classes, which will improve the existing AFCRL backgrounds model. Additional information as to time and spectral variation of some of the more unusual objects will be obtained.

Obtain multicolor measurements using liquid-helium-cooled photometers on telescope at Mt. Lemon, Arizona, and Kitt Peak, Arizona.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory OP L G Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, HUMAN PERFORMANCE EVALUATION OF MATRIX DISPLAYS

L. SCANLAN, Hughes Aircraft Company, *Culver City, California* 90230 (DF319800; F33615-76-C-0503)

The objective of this effort is to provide a comprehensive experimental evaluation of advanced matrix display technology in terms of the simulated image display parameters involved and their effects on human performance. In addition, evaluation techniques will be developed for quantifying and subsequently specifying the characteristics of matrix element displays. The functional relationships and techniques to be generated will provide the developers and users of advanced display media with critically needed design criteria and trade-off data to optimally implement this new matrix display technology.

A simulation will be developed which will allow a wide range of variables associated with matrix element displays to be evaluated in terms of angular subtense of targets at time of recognition. Response surface methodology will be employed to determine the effects of existing and projected state-of-the-art combinations of display parameters to achieve alternative levels of operator performance.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0002, NEUROPHYSIOLOGICAL RESEARCH IN ADAPTIVE NETWORK ARCHITECTURES

C.D. WOODY, Univ. of California, School of Medicine, *Los Angeles, California* 90024 (DF043620; AF-AFOSR-3074-76)

AF function - the Air Force needs new methodologies for the design of improved adaptive networks which are applicable to artificial intelligence operations such as automated image recognition, speech coding and decoding, robotics, and computer-aided decision-making. Deficiency - both brain and machine depend on component operations. There is reason to believe that systems supporting complex, goal-seeking adaptive behavior are best constructed from goal-seeking adaptive components. Limited understanding of how such components work has prevented their incorporation into artificial intelligence systems. Objective - the general objective is to improve the ability to design adaptive network architectures by investigating neuronal adaptive mechanisms underlying intelligent information processing in the brain. How work contributes - this research should lead to an improved understanding of the control of adaptive mechanisms underlying information processing by the brain and afford the design of improved components for use in artificial intelligence. This research is in direct support of efforts at System Avionics Division, AF Avionics Laboratory.

The brain is the most powerful adaptive network known and the basic component of the brain is the neuron. Recent studies indicate that single cortical neurons adapt in relation to adaptive mammalian behavior. By investigating these adaptive neural elements it is hoped to determine if cellular mechanisms controlling this adaptation operate in a goal-seeking manner, which might involve maximization of excitatory or inhibitory conductances, cyclic nucleotide gradients or other measureable variables that influence the level of neural excitability. The approach is to study control of changes in cellular excitability directly in single cortical neurons. The heterostatic theory of adaptive systems proposes that the individual elemental component is itself a goal-seeking system and that the goal sought is a maximal rather than a steady-state condition. This hypothesis deserves consideration and the research proposed appears to so do and is a logical approach to the general problem.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NL Bldg. 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0003, ISD MANAGEMENT AND TECHNICAL REQUIREMENTS

J.P. HYMES, Courseware Incorporated, *San Diego, California* 92108 (DN694022; N61339-76-C-0062)

The diversity of operational contingencies in the simultaneous development of new training programs and new aircraft is such that no single technological approach is sufficient by itself. The objective of this project is to provide techniques and procedures to optimize the individually proven advantages of existing management, technical, instructional and support techniques into a comprehensive management system designed to meet the ISD developmental requirements of any training program during aircraft weapon system RDT and E.

The program effort will be directed toward investigation of existing management of aircraft weapon system acquisition, instructional systems development processes, and training system support requirements to develop modified Navy management procedures and technical requirements to implement training system development in new aircraft weapon systems through the ISD process. These procedures and technical requirements will be applicable to aircrew members and maintenance personnel training systems.

ADDENDA: Supporting agency address is: Naval Training Equipment Center Human Factors Laboratory, Orlando, FL 32813

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0004, FIELD PERFORMANCE MEASUREMENT DATA COLLECTION

D. VREULS, Canyon Research Group Inc., *Thousands Oaks, California* 91361 (DN594016; N61339-75-C-0128)

Prior efforts under project 3754 have utilized available pilot populations in the development of automated performance measurement techniques. Data are now needed from an actual student population in order to validate the techniques for control of the training process.

The techniques developed to date will be implemented for data collection on an operational automated flight training system in the field. The collected data will be analyzed to determine validity of the techniques for automated training.

ADDENDA: Supporting agency address is: Naval Training Equipment Center, Human Factors Laboratory, Orlando, FL 32813

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0005, THE VALIDITY OF VARIOUS MEASURES IN PREDICTING PILOT TRAINING PERFORMANCE

J.M. KOONCE, U.S. Air Force, Frank J. Seiler Res. Lab., *Colorado Springs, Colorado* 80840 (DF281710)

AF function - use of psychomotor tasks for pilot trainee selection and UPT attrition reduction. Deficiency - the attrition rate in UPT is unacceptably high because of the soaring costs of carrying a pilot trainee only part way through UPT. Research - the research will evaluate the use of tracking devices and low-cost simulators as predictors of success in UPT. How research contributes - the results of this research can be applied to pilot trainee selection to reduce flying deficiency attrition. Additionally, the low-cost selection devices investigated would not make an appreciable increase in the cost of selection while improving the accuracy of selection methods. Abstract - T-41 candidates will perform a two-axis tracking task with and without side-task loading.

Results will be correlated with T-41 success, and the success of a later group of T-41 candidates will be predicted from their results on the tracking tasks. The predictive validity of the tracking task will be determined by the actual T-41 performance of the second group. A similar program using GAT-1 performance measures will be performed to furnish validation data for the selection efforts of HRL/PE.

ADDENDA: Supporting agency address is: Frank J Seiler Research Lab NC, USAF Academy, Colo 80840

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0006, INSTRUCTOR PILOT'S ROLE IN SIMULATOR TRAINING

J.P. CHARLES, Appli Mation Incorporated, *Orlando, Florida* 32803 (DN594008; N61339-75-C-0093)

The objective of this task is to define the role of the instructor pilot (and simulator operator, if needed) in all phases of flight training in which an operational flight trainer is an integral tool; and to specify functional designs for a console at which the defined role may be carried out.

The approach will consist of the following steps: (1) review state- of-the-art and survey present and predictable future programs for training instructor pilots; (2) systematically determine requirements for instructor pilot consoles; (3) develop functional designs for consoles based on these requirements.

ADDENDA: Supporting agency address is: Naval Training Equipment Center, Human Factors Lab, Orlando, FL 32813

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0007, CONCURRENT MULTITASK PERFORMANCE MEASUREMENT

R.S. GIBSON, U.S. Navy, Aerospace Psychology Dept., *Pensacola, Florida* 32512 (DN677133)

Naval aviators and flight officers operate complex systems which confront them with the necessity of responding to many simultaneous competing demands. Improvement of total systems efficiency is dependent upon the development of better techniques for specifying and measuring the quality of human performance in complex systems. This project is directed toward the development of a methodology for measuring concurrent multitask performance.

Automated research techniques employing both continuous and discrete display and control characteristics will be used in multitask paradigms requiring the concurrent performance of complex motor and mental tasks. The tasks will be designed to represent the psychological demand characteristics of aircrew tasks and will be capable of being situationally altered to address a broad range of complex performance problems. Task development will emphasize the development of a continuous tracking task and a communication task, both of which will be integrated with a currently existing set of complex performance tasks. Performance measurement will emphasize the development of adaptive task loading techniques as a means of accurately quantifying performance effectiveness under complex multitask conditions.

ADDENDA: Supporting agency address is: Naval Aerospace Medical Research Laboratory, Pensacola, Florida 32512

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0008, EVALUATION OF THE EFFECTS OF TASK INTERFERENCE AND SHIFTING TASK PRIORITIES ON PERFORMANCE

R.S. GIBSON, U.S. Navy, Aerospace Medical Res. Lab., *Pensacola, Florida* 32512 (DN677228)

Changes in cockpit task structure resulting from advances in aircraft technology continually increase the premium on a flight crew's ability to manage information and make rapid decisions while controlling basic flight and navigation functions. Valid techniques are needed for the measurement of such time-shared performances and for their prediction. Performance efficiency can be affected by the difficulty of each individual task, the degree of interference among concurrently performed tasks, shifting individual task demands dictated by mission priorities, and the operator's individual capabilities. The objective of this research is to investigate the relationships among these factors and their implications for system design and aircrew performance.

This investigation will employ a set of automated performance tasks to provide comparative estimates of operator capacity in single-task and multi-task situations. The technique involves manipulations of sub-task demands and measurement of an individual's multi-task capacity relative to his performance on the sub-tasks performed singly. The rationale assumes that maximum performance estimates for individual sub-tasks can be obtained in a short test period and that subsequent performance improvement on each will be small during a single session, thus providing bases for controlled estimates of the effects of task interference and shifting task priorities on performance. While this research will be part of a larger coordinated effort supported by a BUMED 6.2 1498, it has an independent developmental background and its own specific objectives. The principal tasks will represent an initial effort to combine and assess a set of tasks developed at the University of Illinois' Institute for Aviation with complex performance tasks developed under the BUMED 6.2 effort. In addition, this work unit will initiate work directly concerned with the effects of assigned task priorities and their interactions.

ADDENDA: Supporting agency address is: Naval Aerospace Medical Research Lab, Pensacola, FL 32512

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0009, LONGITUDINAL FOLLOW-UP STUDY OF THE PHYSICAL STATUS OF 1000 NAVAL AVIATORS

R.E. MITCHELL, U.S. Navy, Aviation Medicine Division, *Pensacola, Florida* 32512 (DN540719)

To provide data from the 1000 aviator study which will allow the establishment of more physical standards for aviation and to provide methods of early prediction of alterable or preventable conditions with the ultimate goal of extending the useful life of the naval aviator.

A unique study of aging in a pilot population, consisting of naval aviators, was started in 1940. Subsequent to the initial examinations the members of the group were reexamined in 1952, 1958, 1964, and 1969, the data from each reassessment contributing to a three-decade study, the longest study ever made on a pilot population.

ADDENDA: Supporting agency address is: Naval Aerospace Medical Research Lab, Pensacola, FL 32512

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0010, ENVIRONMENTAL DEGRADATION OF AIR FORCE CHEMICALS IN AIR, WATER AND SOIL

R.C. INMAN, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320520)

To study the degradation of Air Force critical materials when introduced into an aquatic or terrestrial environment. Propellants and fuels are currently being handled in a variety of programs from development studies through operational launches. In the course of these programs, some of these chemicals may be released into the environment by the venting of fuel systems, the dumping of scrubber system waters, inadvertent spills or aircraft accidents. The persistence of a chemical in the environment is a necessary part of any chemical hazard assessment to an ecosystem. Factors which alter compound degradation rates must also be identified in order to adequately manage accidental aquatic or terrestrial spills and to provide information for safe disposal or decontamination of the agent.

Initially, degradation rate kinetics will be determined in soil and water. The degradation products will be identified to discount the possibility that they do not present a more significant hazard than the parent compound. Then, those factors which alter the compound degradation rates will be investigated. This information along with the data derived on any given chemical under other environmental effects studies will then be used in compiling environmental impact statements or assessments on weapons systems employing these chemicals. The complexity and variability of aquatic and soil systems will require continuing methodology development in order to provide viable data used over widespread geographical areas.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab, TH, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0011, DETERMINATION OF PHYSIOLOGICAL CRITERIA FOR DESIGN OF NAVAL AIRCREW VISUAL DEVICES

G.T. CHISUM, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974 (DN581104)

To determine the physiological capabilities and limitations of the human visual system under airborne operational conditions requiring the use of visual display devices and specify the criteria to be satisfied in the design of visual display devices. The requirement for this work was established by new research code, PA-6 of the FY 1974 Naval Aviation Biomedicine/Human Effectiveness Technical Workshop Report.

Physiological assessment of the visual system in terms of adaptation, acuity, accommodation and sensitivity will be coordinated. Basic laboratory techniques and novel techniques as required will be used to assess the visual capabilities. Criteria will be established for use by display designs.

ADDENDA: Supporting agency address is: Commanding Officer, Naval Medical Research, National Naval Medical Center, Bethesda, Maryland 20014

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0012, BIOCHEMICAL PREDICTORS OF STRESS INTOLERANCE IN FLIGHT PERFORMANCE OF NAVAL AIRCREWMEN

B.D. POLIS, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974 (DN840402)

To obtain an objective molecular indication of the cumulative effects of physical and mental stress and fatigue and to identify predictors of stress reactions in naval aircrewmen. Requirements for this work appear in the FY1974 Naval Aviation Biomedicine/Human Effectiveness Technical Workshop Report.

Response of humans and animals to stress has been correlated with quantitative changes in specific blood phospholipids and the appearance of o-hydroxy hippuric acid (OHH) and free radical substances in urine have been found associated with a debilitating anxiety. Navy populations in stressful operational conditions will be sampled for body fluids with the emphasis on non-invasive determinants of stress intolerance. Analytical data will be correlated with physiological, mental and performance states by the multi-variant statistical procedures developed for phospholipids in blood to offer an objective end point for TEH exhaustion of adaptive mechanisms and the onset of pathology in Navy flight personnel.

ADDENDA: Supporting agency address is: Naval Medical Research and Development Command (BUMED 71), National Naval Medical Center, Bethesda, MD 20014

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0013, THERMAL PROTECTION FOR FLIGHT CREWS

A.M. STOLL, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974 (DN581425)

To provide 1) thermally safe operating conditions for aircrews in normal flight in current and advanced design aircraft and 2) protection from thermonuclear weapons effects in unconventional warfare operations. Requirements for thermal protection are indicated in the Naval Aviation Biomedicine/Human Effectiveness Technical Workshop Report for FY 1974.

Basic data will be obtained on the production of pain and burns on contact with a wide variety of materials of different thermal properties. From these data a mathematical formulation will be derived for predicting the maximum permissible temperature of any material for safe contact with bare skin solely from a knowledge of the thermal constants of the material. Additional studies will be made to delineate the limits of non-injurious exposure to thermal effects of the high- intensity non-ionizing radiation from nuclear weapons in the projected shirt-sleeve environment to constitute a basis for providing protection where necessary.

ADDENDA: Supporting agency address is: National Naval Medical Center, Bethesda, MD 20014

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0014, MEDICAL DIAGNOSTIC STANDARDS FOR OBESITY

R.S. DRYDEN, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF318150)

To attempt to correlate body composition studies performed on individuals evaluated on the USAFSAM Aeromedical Consultation Service with the current weight standards contained in AFM 160-1, Attachment 1, Table A. To correlate body composition and cardiovascular performance as measured by treadmill exercise stress testing. To assist in developing a nomogram for use in identifying individuals with extremes in body composition by measurement of the fixed bicep.

The SAM charts of 1,000 patients will be reviewed and the following information obtained: height, weight, age, lean body mass, percent body fat, ideal oxygen consumption in cc/kg/min. An attempt will be made to correlate the patient's exercise tolerance and oxygen consumption with his exercise program and body composition. Measurement of the fixed bicep will be accomplished on all patients undergoing complete aeromedical evaluation.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0015, CONTAMINANT ANALYSIS OF COMPRESSED BREATHING AIR SYSTEMS

K.G. IKELS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF320190)

This effort will provide local air base technicians with instrumentation and methods for assessing the contaminant content of compressed breathing systems. Compressed breathing air is used by the Air Force in a variety of applications ranging from emergency escape devices to pressurized aircraft cabins. The purity specifications governing the use of breathing air include Technical Order 42 B-1-22, Federal Standard BB-A-1034A, OSHA Guideline 1910.134 and USAF Special Bulletin 526A, each with its unique list of contaminant limits. This effort is specifically addressed to an Air Training Command letter requirement related to aircraft cabin oil fumes, and a USAFSAM requirement related to hyperbaric air supplies.

This effort is an expansion of work initiated under JON 71641601. Major effort in FY 76 and 77 will be the development of a new infrared technic for field analysis of oil vapor as required in both USAF hyperbaric facilities and aircraft cabins. Effort will also be made to adapt the aviator's breathing oxygen contaminant analyzer for assessing individual contaminants in compressed breathing air. In addition, a contractually developed solid-state trace-contaminant analyzer will be available in mid-1976 for initial laboratory and field testing.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0016, PERSONNEL TECHNOLOGY - EFFECTS OF LIFE STRESS AND COPING SKILLS ON PERFORMANCE AND ORGANIZATIONAL EFFECTIVENESS

I.G. SARASON, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (DN575416; N00014-75-C-0905)

In developing personnel who will later be exposed to high levels of stress (e.g., aviators, submariners, UDT personnel), the Navy and Marine Corps are limited by gaps in our knowledge of the fundamental relationships among situational stressors, life stress, individuals' coping skills, and organizational effectiveness. This work unit is designed to clarify these relationships and experiment with various individual and organizational procedures for improving the ability to cope with stress in organizational contexts.

Earlier research has demonstrated that stress is associated with morbidity and with decreased performance in certain kinds

of situations. This research will produce new measures designed to assess organizational stress. The investigator is experimenting with various techniques for altering cognitive responses since these are hypothesized to be involved in mediating the deleterious effects of stress on performance. The initial experiments in civilian groups exposed to high levels of job stress (e.g., firemen) will, if successful, be extended to certain military groups working under high-stress conditions.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, GENERALIZED VTOL SIMULATION MATHEMATICAL MODEL

W. YIH, U.S. Navy, Computer Laboratory, *Orlando, Florida* 32813 (DN594003)

The purpose of this task is to formulate a generalized VTOL math model (including engine model). The math model will then be simplified to a few VTOL aircraft models which have potential to be turned into production models. The model will be used to evaluate the dynamic response, handling quality and visual coupling of VTOL aircraft training devices. Other potential use of the model will be to study the interface problems with sea control ships under high speed and sea state, thereby improving pilots' landing technique.

NAVTRAEQUIPCEN technical reports 1205-2 and 6 will be used as references. The aerodynamic and engine data for specific VTOL aircrafts will be purchased. The primary effort will emphasize simulating ground effect and transition flight. The models will be implemented on the Sigma 7 computer. Existing aircraft computer programs will be used as guides but will be extensively modified to accommodate variable configurations of VTOL aircrafts.

ADDENDA: Supporting agency address is: Naval Air Systems Command Instrumentation and Flight Controls, Washington, D. C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

7.0002, APPLIED DIFFERENTIAL EQUATIONS

M.G. CRANDALL, Univ. of Wisconsin, Mathematics Research Center, *Madison, Wisconsin* 53706 (DA0M9690; DAAG29 75 C 0024)

Continue and extend studies of differential equations in order to provide a better foundation for the design of Army weapons, vehicles, aircraft, communications and supply systems, and protective equipment. There will be special attention to the influence of boundary conditions on the character of the solutions, special study of the asymptotic behavior of the solutions near singular points, and special attention to other topics from time to time.

A staff of mathematicians who are proficient in this area is regularly employed. A weekly seminar in which problems are discussed and new results are presented stimulates interaction of the members of this group with each other and with interested colleagues from other groups within the center and with members of other departments. Access to an electronic computer, with programming support, is provided to aid in numerical experimentation.

ADDENDA: Supporting agency address is: DARCOM Army Rsch. Office, (ARO-D), P O Box 12211 Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, MOLECULAR AND SOLID-STATE SPECTROSCOPY

H.P. BROIDA, Univ. of California, School of Letters & Science, *Santa Barbara, California* 93106 (PHY74-22174 A01)

This proposed research will pursue two sets of experiments, one dealing with very small, solid particles and the other with gas-phase dimers of metals. The formation and properties of small (2-1000 nm) homogeneously nucleated particles will be investigated by light scattering and by electron microscopy. Particle size measurements from light scattering will be compared to those found by electron microscopy. Dimer states of the alkaline earth materials will be probed by laser photoluminescence to obtain detailed knowledge of the molecular structure of the diatomic species. It will also be possible to learn about long-range interactions of atomic collisions as well as to obtain potential curves of the bound states of the dimers. The alkaline earth dimers are potentially good candidate systems for tunable lasers in the visible and near ultraviolet spectral regions. This work represents a continuation of that currently supported by Foundation grant PHY74- 22174.

SUPPORTED BY U.S. Natl. Science Foundation

8.0002, SOME PROBLEMS IN THEORETICAL PHYSICS

G. FELDMAN, Johns Hopkins University, Graduate School, *Baltimore, Maryland* 21218 (PHY76-23469)

Research will be carried out in the physics of the new particles, the Bethe-Salpeter equation, relativistic atoms and Quantum Electrodynamics, electromagnetic and weak interactions of nuclei and various aspects of field theory.

This work represents a continuation of that currently supported by Foundation grant PHY75-01052 A01.

SUPPORTED BY U.S. Natl. Science Foundation

8.0003, EXPERIMENTAL AND THEORETICAL STUDIES OF NUCLEATION PHENOMENA

J.L. KASSNER, Univ. of Missouri, School of Science, *Rolla, Missouri* 65401 (ATM75-16900 A01)

This research involves studies of various aspects of homogeneous nucleation which have served as a convenient means of testing concepts employed in a general molecular theory of nucleation which is readily adapted to describing surface phenomena. For example the latter shows considerable potential for solving the problem of the growth habit of ice. Previous work on ion mobilities provides a convenient testing ground for evaluating theoretical methods for describing the intermolecular force fields which surround fine particles. Such matters are not only of general importance in nucleation kinetics but also to the problem of the mechanics of systems of fine particles (coagulation of aerosols).

A cloud chamber method has been developed for the study of the ion species emitted through electrical spraying and corona processes. An increasing emphasis on atmospheric electrical problems is planned, with special interest being devoted to problems related to the initiation of breakdown in the atmosphere. The application of the principles of molecular physics to the properties of cluster ions shows particular promise.

SUPPORTED BY U.S. Natl. Science Foundation

8.0004, THEORETICAL STUDIES ON PLASMA HEATING AND CONFINEMENT

R.N. SUDAN, Cornell University, School of Engineering, *Ithaca, New York* 14850 (E(11-1)-3170)

The work consists of theoretical and computational studies of: (1) low-frequency and high-frequency stability of field-reversed equilibria; (2) theory of strong turbulence induced by the interaction of high- powered relativistic electron beams with plasma; (3) rf heating in low beta plasmas such as tokomaks with emphasis on wave frequencies of the order of the lower hybrid and ion cyclotron frequencies.

RESULTS TO DATE: New energy principles for the stability of large larmor field-reversed ion rings have been developed; one- and two- dimensional solitons turbulence has been generated in numerical codes; lower hybrid waves, energy propagation and the resulting deposition plasma heating and transport have been studied theoretically and incorporated into a computer program.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - C.T.R.D.

8.0005, DETERMINATION OF NEUTRON CAPTURE CROSS SECTIONS AND RESONANCE PARAMETERS
R.R. WINTERS, Denison University, School of Liberal Arts, *Granville, Ohio* 43023 (EY-76-S-02-2696)

A paper will be written reporting the very interesting results of the joint analysis of the Tl(n,gamma) and Tl(n,x) experiments. Strength functions, resonance parameters and effective nuclear radii have been obtained for the energy range 2.5-250 keV.

Significant difficulties with the detector's sensitivity to sample- scattered neutrons have delayed the analysis of the Te(n,gamma) data. A 208Pb(n,gamma) experiment performed this summer must be analyzed for the scattered neutron sensitivity and to establish limits for the experimental errors for the corrections due to effects of resonance- scattered neutrons. Upon resolution of this difficulty, analysis of the Te(n,gamma) data will be continued through the period of the proposed research program.

Some analysis of the V(n,gamma) data above 100 keV remains to be done, mostly Monte Carlo calculations for s-wave resonances. Recent work by Bird, Bolderman (Australian AEC), et al., suggests that the valency model of neutron capture should be capable of making very good predictions of radiation widths. Results of the model will be compared with the radiative widths obtained from the V(n,gamma) data. A paper will be prepared reporting the results of the V(n,gamma) analysis. The comparison with the valency model will be reported in a separate paper.

RESULTS: 205Tl(n,x): a) 200 resonances analyzed 2.5-250 keV, using R-matrix and a Breit-Wigner fitting code. b) s- and p-wave strength functions measured. c) Possible intermediate structure found above 50 keV. d) Effective nuclear radii determined for both parity resonances.

BIBLIOGRAPHIC REFERENCE: 'Stellar Neutron Capture in the Stable Thallium Isotopes,' with R.L. Macklin, Astrophys. J. 208, No. 3 p. 812 (1976).

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0006, OPTICAL AND ACOUSTICAL SPECTROSCOPY OF SOLIDS
E. BURSTEIN, Univ. of Pennsylvania, School of Arts & Sciences, *Philadelphia, Pennsylvania* 19104 (DN723089; N00014-76-C-0107)

The interaction of electromagnetic waves with solids yields information for developing new solid-state materials for ir detectors, windows, and electronic devices which will find application in naval electronic, communication, and surveillance systems.

Surface electromagnetic waves and surface acoustic waves and their interactions with electrons in solids and with each other are studied to give the electrical properties of solid-state materials. The interaction of surface electromagnetic waves (polaritons) with anisotropy dielectric and permeable solids will be studied via techniques such as attenuated total reflection (ATR).

ADDENDA: Supporting agency address is: Office of Naval Research 427, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0007, EXPERIMENTAL NUCLEAR STRUCTURE RESEARCH
J.H. HAMILTON, Vanderbilt University, School of Arts & Sciences, *Nashville, Tennessee* 37232 (E-(40-1)-5034)

Studies of the coexistence of spherical and deformed shapes in nuclei far from stability in the region of the closed shell, z equals 82, will be continued. Problems to be investigated are: Is 182Hg deformed in its ground state; Does coexistence occur in Pb and Po isotopes as now predicted theoretically; Are the O deformed band heads in 186,188Hg really shaped isomeric, and what are the lifetimes of O states in 184,185 Pt? The 68,70Ge nuclei have breaks in their yrast bands at 8 plus not seen in 72,74Se nuclei which may be related to a two-proton g 9/2 configuration. In-beam studies of 66,72Ge and 78Se will be carried out and 68Ge repeated to eliminate radioactive contaminate to test this idea. Lifetime measurements to high spins in 176Hf and 164Er will be done at super HILAC to investigate parity and K quantum number yrast traps and backbending of the moment of inertia. Coulomb nuclear interference studies of 192Pt and 180Hf will be done to test theoretical calculations of the sign of the interference of 1 and 2 step excitations of the second 2 ion states and the sign and magnitude of the E4 moment, respectively. The first precise Coulomb excitation studies of Nd and Hg isotopes will be done. Heavy-ion transfer studies will be made to investigate anomalous behavior of stripping and pick up reactions into odd-odd nuclei. The 12C(7Li,6He)13N and 13C(7Li,6He)14N reactions will be studied.

RESULTS: Coexistence of spherical and deformed bands were extended to 184Hg through studies of new isotope 184Tl. The O band head is isomeric. The alpha decays of Tl isotopes were studied. In 74Se, a rotational band built on a 3 negative ion octupole state was discovered for the first time outside deformed nuclei. In 68,70Ge the yrast cascades behaved quite differently from 72,74Se with breaks at the 8 states. A new 10-100 times faster computer program for the analysis of heavy-ion transfer reactions was completed and is a real breakthrough. The 13C(7Li,6He)14N reaction was studied. Analysis of 156,158Dy, 162,164Er, and 168Yb Coulomb excitation data was completed. Coulomb excitation of 192,194Pt clarified ambiguities in older data.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0008, HIGH-ENERGY PHYSICS RESEARCH
L.W. MO, Virginia Poly. Inst. & St. U., Graduate School, *Blacksburg, Virginia* 24061 (PHY76-23478 A01)

This research is a two-part program and is being conducted at the Fermilab.

A study will be made of deep inelastic scattering of 200 GeV mu mesons from hydrogen and deuterium in a collaborative experiment with groups from Oxford University, University of Chicago, and Harvard University. The experiments will give results bearing on questions of scaling, structure functions and parton composition of the nucleon.

A measurement of nu micron-electron scattering cross sections in the few-hundred-GeV range will be made in a collaborative experiment with Oxford University. The experiment will give fundamental information on the properties of the weak interactions and particularly weak neutral currents.

This work represents a continuation of that currently supported by Foundation grant PHY76-23478.

SUPPORTED BY U.S. Natl. Science Foundation

8.0009, SURVEILLANCE - PROPERTIES OF MATERIALS FOR SUPERCONDUCTING SENSORS
B. DEAVER, Univ. of Virginia, School of Arts & Sciences, *Charlottesville, Virginia* 22903 (DN923065; N00014-75-C-0854)

The objective of this task is to study the electronic and magnetic properties of superconducting materials for use in surveillance sensors. New superconducting circuits capable of detecting minute magnetic field changes are being investigated.

This task comprises a variety of experimental investigations in the field of cryogenics. These include: studies of the electrical resistance and magnetoresistance of ferromagnetic metals at temperatures down to 0.3 deg K; electron tunneling experiments on ferromagnetic metallic and magnetic oxide junctions; magnetic flux measurements on superconducting rings and thin films; the properties of liquid helium and development of a three-dimensional magnetic wind-tunnel balance system using superconducting magnets.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, SPECTROSCOPIC OBSERVATIONS OF QUASARS
M. SCHMIDT, Calif. Inst. of Technology, Carnegie Inst. of Washington, *Pasadena, California* 91125 (AST75-22923 A01)

A search for spectroscopic studies of bright quasars will be carried out. Spectra and redshifts of very faint quasars will be obtained and spectroscopic studies of quasars identified with radio sources or X-ray sources will be continued. The study of bright quasars will yield information on the density increase with redshift of which only the gross characteristics are known at present. Observations of redshifts of very faint quasars will supply information about the suspected cutoff in the density increase at redshift 2.5 which may be related to the epoch of galaxy information. Spectroscopic studies of radio quasars are designed to improve our knowledge of the radio luminosity function of quasars, while those of quasars identified with X-ray sources will supply much-needed information about the X-ray properties of quasars.

This is a continuation of work previously supported by NSF grant AST75 22923.

SUPPORTED BY U.S. Natl. Science Foundation

10.0002, RESEARCH IN THE CIRCULATION OF THE SOLAR ATMOSPHERE
H. ZIRIN, Calif. Inst. of Technology, Graduate School, *Pasadena, California* 91109 (ATM76-21132)

This grant will support a general program of research in solar physics at the Big Bear Solar Observatory, Pasadena, California. Particular subjects to be attacked are: 1. The fine structure of the solar chromosphere; its evolution and connection with magnetic fields. 2. The solar granulation, brightness, fluctuation and lifetime of granulation and the connection of granulation with chromospheric structure. 3. The evolution of weak magnetic fields on the surface of the sun. 4. Coronal holes as observed through optical phenomena. 5. Solar rotation, as measured by rotation of surface features. 6. Solar activity and solar flares; the development of solar active regions, evolution of solar magnetic fields, oscillatory phenomena in sunspots, and the three-dimensional structure of active region fields. 7. Comparison of optical and high-energy data. 8. Measurement of the solar constant with a cavity radiometer. 9. Quantitative measurement of filtergrams. 10. Measurement of plage brightness at the extreme limb.

The general aim of this grant is to further our understanding of solar-terrestrial relations by the analysis of high-quality photographic data on solar activity.

SUPPORTED BY U.S. Natl. Science Foundation

10.0003, A STUDY OF HOT STARS WITH EXPANDING ATMOSPHERES
D.G. HUMMER, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (AST76-22032)

The objects to be studied in this research program are the very hot and luminous stars. These include those of the Of type and the Wolf- Rayet stars. The latter are among the most active in that they are ejecting their outer atmospheric layers at a rate sufficient to exhaust half the mass of the star within its lifetime. Previous efforts by the principal investigators have given a powerful arsenal of new radiative transfer techniques with which to study these stars, and a useful theory of the process of ejection. A picture has emerged of an important way in which the stars, through 'bubbles' formed by the stellar wind, interact with the interstellar medium. Included among the facets to be investigated are: (1) the excitation equilibria in Of stars of the ions He II, N III and C III; (2) the effects of stellar rotation on the principal investigator's dynamical stellar model; (3) the temperature and velocity structure of Wolf-Rayet stars as revealed by studies of the ionization balance; and (4) tying the principal investigator's models of Of stars more closely to observation by studying the temperature structure and the effect of line blanketing on the continuous spectrum.

SUPPORTED BY U.S. Natl. Science Foundation

10.0004, OBSERVATIONAL STUDIES BEARING ON STELLAR EVOLUTION
R.D. MCCLURE, Yale University, School of Science, *New Haven, Connecticut* 06520 (AST76-22672)

The research to be completed in this proposal is aimed at improving the observational data bearing on the ages and element abundances of stars and star clusters. These data will provide a better understanding of the chemical history of the Galaxy and nearby external galaxies, as well as improve the understanding of stellar evolution. Photometric and spectroscopic observations of star clusters in the Milky Way Galaxy and in the Magellanic Clouds, our nearest neighboring galaxies, will be made. These observations on old stellar systems combined with data on stars in the general field of the solar neighborhood also will provide information bearing on models of the formation of the halo and disk of the Milky Way Galaxy.

SUPPORTED BY U.S. Natl. Science Foundation

10.0005, COMMUNICATIONS - SOLAR FLARES AND COMMUNICATIONS
R.F. HOWARD, Carnegie Inst. of Washington, *Washington, District of Columbia* 20005 (DN723093; N00014-76-C-0113)

The communications, navigation, and long-range detection systems are degraded or completely disrupted by ionospheric and magnetospheric disturbances caused by solar flare activity. This research will investigate the behavior of magnetic fields on the solar surface, the interaction of magnetic fields with the solar plasma, and the influence of these factors on the solar wind and the interplanetary magnetic field as a function of flare activity. An understanding of solar flare activity and the ability to predict flare activity and the resulting geomagnetic disturbances are goals of this program.

The work will consist of obtaining and reducing data from the solar magnetograph at the Mount Wilson Observatory, which will provide information concerning magnetic and velocity fields on the sun. The results will be analyzed for basic processes in the development and decay of solar active regions and in the solar activity cycle. Full-disc observations as well as fine-scan observations will be made. Specific observing programs will include a study of the magnetic fluxes, lifetimes, and rotation rates of small magnetic features. These are important characteristics of the fundamental magnetic elements on the sun. Data reduction of accumulated material will continue with emphasis on circulation patterns of the solar atmosphere and the relation of these patterns with solar activity.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

10.0006, SOLAR ACTIVITY INTERFERENCES WITH IONOSPHERE-DEPENDENT MILITARY SYSTEMS
R.W. KREPLIN, U.S. Navy, Res. Laboratory, *Washington, District of Columbia* 20375 (DN920016)

To develop techniques to predict and evaluate disturbances to ionosphere-dependent military systems, e.g., communications, navigation and surveillance. To further the understanding of the mechanisms of solar activity and to support objectives of the SOLRAD program.

Solar plasmas are studied to determine the physical mechanisms of solar activity. Observations are made with X-ray and gamma-ray spectrometers, X-ray cameras and scanning devices. The spectra of laser- produced laboratory plasmas are also investigated to aid solar plasma investigations.

ADDENDA: Supporting agency address is: Naval Research Laboratory (7000), Washington, D.C. 20375

SUPPORTED BY U.S. Dept. of Defense - Navy

10.0007, DETERMINATION OF THE MOTION OF THE MOON
P.K. SEIDELMANN, U.S. Navy, Observatory, *Washington, District of Columbia* 20390 (DN546001)

Support and augment the technical/operational programs and activities of the Naval Observatory in accordance with its

Navy and Department of Defense mission on navigation and time determination, by improving the constants of the moon and its reference system from analysis of observations.

Occultation data, precise lunar photographs, solar eclipse timings, laser ranging measurements and the motion of the reference system, and meridian circle observations of the moon will be analyzed for the motion of the moon, the exact figure of the moon, and the lunar profile and its librations.

ADDENDA: Supporting agency address is: Naval Observatory, Washington, D. C. 20390

SUPPORTED BY U.S. Dept. of Defense - Navy

10.0008, DEVELOPMENT OF IMPROVED PLANETARY AND SATELLITE MOTIONS

P.K. SEIDELMANN, U.S. Navy, Observatory, *Washington, District of Columbia* 20390 (DN546002)

Support and augment the technical/operational programs and activities of the Naval Observatory in accordance with its Navy and Department of Defense mission on navigation and time determination, by studying the motions of the planets and satellites to improve the accuracy of their calculated positions at past and future times. These theories are basic to the navigational tables and almanacs used for surface, air and space navigation.

Construct mathematical theories of the motions of the planets and satellites, compare these motions with observations, determine constants for the theories and other astronomical constants, and adapt the theories to practical use. Ephemerides of planet and satellite positions are computed based on these improved theories.

ADDENDA: Supporting agency address is: Naval Observatory, Washington, D.C. 20390

SUPPORTED BY U.S. Dept. of Defense - Navy

10.0009, SOLAR CORONAL WAVES

J.B. ZIRKER, Univ. of Hawaii, School of Arts & Sciences, *Honolulu, Hawaii* 96822 (DF243140; F19628-75-C-0067)

AF function - communication, surveillance, detection, tracking. Deficiency - inadequate solar disturbance predictions. Research - observational research to detect the solar coronal heating process. Approach - the contractor will perform an observational search for solar coronal waves. The work involves serial spectrographic observations from the Haleakala Observatory of the profiles of the coronal green line (lambda 5303) throughout coronal enhancements. This research forms an integral part of project 7649 - Solar Environmental Effects Energy Transport effort under work unit 76490605.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, L G Hanscom AFB, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

10.0010, GRAVITATIONAL PHYSICS AND RELATIVISTIC ASTROPHYSICS

S. CHANDRASEKHAR, Univ. of Chicago, Graduate School, *Chicago, Illinois* 60637 (PHY76-81102)

Research on a broad range of topics in theoretical relativity and relativistic astrophysics initiated under NSF grant PHY74-17456 AO2 will continue. Specific topics of investigation will include: Chandrasekhar: 1. Solution of linearized perturbation equations for the Kerr Metric. 2. Dirac equation in Kerr geometry. Geroch: 1. Counterexamples to the Hopf conjecture. 2. Reasonableness of definition of 'asymptotic simplicity' for fields in space-time. 3. Description of singularities in general relativity. Ipser: 1. Construction and stability of differentially rotating relativistic models of fully relativistic fluid bodies. 2. Distribution of stars around a black hole located at the center of a cluster. Wald: 1. Effective stress-tensor for particles created by a strong gravitational field. 2. Back reaction of particle production upon black holes or cosmological evolution.

SUPPORTED BY U.S. Natl. Science Foundation

10.0011, THEORETICAL STUDIES IN ASTROPHYSICS

E.E. SALPETER, Cornell University, School of Physical Sciences, *Ithaca, New York* 14850 (AST75-21153 A01)

Work will be completed on calculations of the destruction of interstellar dust grains during collisions between interstellar clouds, and on the formation of dust grains in the atmospheres of cool supergiants. The interpretation of observational data on planetary nebulae, with the aim of developing a theory of the expansion of the nebula will be continued. Radiative cooling of supernova remnants, with special emphasis on X-ray emission lines, is now underway and will be pursued further. There will be studies on the nuclear physics and statistical mechanics of neutron star cooling, on the rotation of neutron stars, on the flow patterns of matter and radiation during neutron star accretion, and on possible instabilities during such accretion. Various projects will involve the dynamic evolution of globular clusters. The effects of a black hole at the center of the cluster will be considered. The decrease in ellipticities of globular clusters due to the escape of stars with excess angular momentum will be studied. Areas in observational cosmology to be treated will include a study of the spiral galaxies in and near the Virgo cluster, and a study of the density distribution of the cluster itself.

This is a continuation of work previously supported by NSF grant AST-75-21153.

SUPPORTED BY U.S. Natl. Science Foundation

10.0012, ASTROMETRIC STUDY OF NEARBY STARS

S.L. LIPPINCOTT, Swarthmore College, Graduate School, *Swarthmore, Pennsylvania* 19081 (AST76-21315)

Only in the immediate neighborhood of the sun can the distances, true brightness, and motions of the stars be accurately determined. For binary star systems, which are more numerous than single stars, orbital motion can be derived yielding the masses of the components. Such masses are required by the astrophysicists in their study of the origin, energy production and evolution of the various stellar types. Cyclic deviations in the motions of some of these nearby stars lead to the discovery and study of unseen companion stars, and the potential discovery of planetary companions. The long-range astrometric study of nearby stars from planets taken with the Swarthmore 61cm refractor has provided a prime source of information about our stellar neighborhood.

Precision astrometric observations will be continued for deriving the distances and motions of nearby stars, and for detecting possible low-mass companions. Also observations will be made of binary systems for the determination of orbital motion and, in favorable cases, the masses of the stars. Special studies will include: a. Better methods of reduction from relative to absolute parallax, b. Photometry of the object and reference stars, c. Evaluation of adjacency and blending effects of close binary components on the photographic plate, d. Continued effort to discover and reduce systematic errors.

Price support was by NSF grant AST 74-17706.

SUPPORTED BY U.S. Natl. Science Foundation

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N77-23046*+ National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 81
Mar. 1977 104 p refs
(NASA-SP-7037(81)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 310 reports, articles, and other documents introduced into the NASA scientific and technical information system in February 1977. Author

N77-23047# Naval Academy, Annapolis, Md.
INVESTIGATION INTO THE FEASIBILITY OF UTILIZING WIND SHEAR FOR OBTAINING CONTINUOUS NON-POWERED FLIGHT
Frederick G. Johnson 3 Jun. 1976 57 p refs
(AD-A032716; USNA-TSPR-78) Avail: NTIS HC A04/MF A01 CSCL 01/2

The feasibility of utilizing an atmospheric velocity gradient for obtaining continuous non-powered flight was analyzed mathematically and experimentally. It was discovered that there seems to be no theoretical bar to using wind shear for this purpose. The velocity gradients in the upper atmosphere were found to be too weak for maintaining continuous non-powered flight. But in the vicinity of the earth's boundary layer wind shear strengths necessary for this purpose were observed. A theoretical flight pattern was developed numerically analyzed and flight tested - using a powered aircraft to simulate high performance sailplanes. Though an increase in aircraft performance was realized, a zero net loss of altitude was not achieved. It is concluded, however, that further research is warranted, especially concerning the related topics of jet stream shears, vertical updraft considerations and more efficient flight schedules. Author (GRA)

N77-23048# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
THE MAGNITUDE OF INTERNAL REWORK ON THE F-4 AIRCRAFT DURING DEPOT LEVEL MAINTENANCE AT OGDEN AIR LOGISTICS CENTER M.S. Thesis
John B. Berry and Raymond M. Hines Sep. 1976 85 p refs
(AD-A032458; SLSR-11-76B) Avail: NTIS HC A05/MF A01 CSCL 15/5

In May 1975, Mr. J. Turk, Office of the Secretary of Defense, expressed a desire to estimate the magnitude of rework cost within AFLC to determine if it was of sufficient magnitude to warrant special attention in all services. Ogden ALC was selected as a test area for this research. The primary objectives of the research were: (1) determine the magnitude of rework cost for the F-4 aircraft during depot level maintenance, (2) identify the major areas of rework, their primary causes, and their cost magnitudes, (3) develop a standard methodology for identifying and classifying rework in terms of maintenance areas, causes, and cost magnitudes, and (4) stimulate interest for conducting similar research at other ALCs and TRCs with the major emphasis on reducing rework cost. Author (GRA)

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N77-23049*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED AERODYNAMIC CHARACTERISTICS OF A 13-PERCENT-THICK AIRFOIL SECTION DESIGNED FOR GENERAL AVIATION APPLICATIONS
Robert J. McGhee, William D. Beasley, and Dan M. Somers May 1975 57 p refs
(NASA-TM-X-72697) Avail: NTIS HC A04/MF A01 CSCL 01A

Wind-tunnel tests were conducted to determine the low-speed section characteristics of a 13 percent-thick airfoil designed for general aviation applications. The results were compared with NACA 12 percent-thick sections and with the 17 percent-thick NASA airfoil. The tests were conducted ovar a Mach number range from 0.10 to 0.35. Chord Reynolds numbers varied from about 2,000,000 to 9,000,000. Author

N77-23050*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A GREEN'S FUNCTION FORMULATION FOR A NONLINEAR POTENTIAL FLOW SOLUTION APPLICABLE TO TRANSONIC FLOW
A. J. Baker (Computational Mechanics Consultants, Inc., Knoxville, Tenn.) and Charles H. Fox, Jr. Apr. 1977 34 p refs
(NASA-TM-X-74014) Avail: NTIS HC A03/MF A01 CSCL 01A

Routine determination of inviscid subsonic flow fields about wing-body-tail configurations employing a Green's function approach for numerical solution of the perturbation velocity potential equation is successfully extended into the high subsonic subcritical flow regime and into the shock-free supersonic flow regime. A modified Green's function formulation, valid throughout a range of Mach numbers including transonic, that takes an explicit accounting of the intrinsic nonlinearity in the parent governing partial differential equations is developed. Some considerations pertinent to flow field predictions in the transonic flow regime are discussed. Author

N77-23051*# Wichita State Univ., Kans. Dept. of Aeronautical Engineering.
AN ANALYTICAL MODEL FOR HIGHLY SEPERATED FLOW ON AIRFOILS AT LOW SPEEDS Final Report
Glen W. Zunnalt and Sharad N. Naik 1 May 1977 115 p refs
(Grant NsG-1192)

(NASA-CR-152702; Rept-77-2) Avail: NTIS HC A06/MF A01 CSCL 01A

A computer program was developed to solve the low speed flow around airfoils with highly separated flow. A new flow model included all of the major physical features in the separated region. Flow visualization tests also were made which gave substantiation to the validity of the model. The computation involves the matching of the potential flow, boundary layer and flows in the separated regions. Head's entrainment theory was used for boundary layer calculations and Korst's jet mixing analysis was used in the separated regions. A free stagnation point aft of the airfoil and a standing vortex in the separated region were modelled and computed. Author

N77-23052*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND TUNNEL INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS OF SYMMETRICALLY DEFLECTED AILERONS OF THE F-8C AIRPLANE

Joseph Gera Apr. 1977 120 p ref

(NASA-TM-X-74008) Avail: NTIS HC A06/MF A01 CSCL 01C

A .042-scale model of the F-8C airplane was investigated in a transonic wind tunnel at high subsonic Mach numbers and a range of angles of attack between-3 and 20 degrees. The effect of symmetrically deflected ailerons on the longitudinal aerodynamic characteristics was measured. Some data were also obtained on the lateral control effectiveness of asymmetrically deflected horizontal tail surfaces. Author

N77-23053*# Computational Mechanics Consultants, Knoxville, Tenn.

COMOC 2: TWO-DIMENSIONAL AERODYNAMICS SEQUENCE, COMPUTER PROGRAM USER'S GUIDE Final Report

P. D. Manhardt, J. A. Orzechowski, and A. J. Baker Feb. 1977 81 p refs

(Contracts NAS1-14307; NAS1-14024)

(NASA-CR-145165; CoMoC-77TR-3) Avail: NTIS HC A05/MF A01 CSCL 01A

The COMOC finite element fluid mechanics computer program system is applicable to diverse problem classes. The two dimensional aerodynamics sequence was established for solution of the potential and/or viscous and turbulent flowfields associated with subsonic flight of elementary two dimensional isolated airfoils. The sequence is constituted of three specific flowfield options in COMOC for two dimensional flows. These include the potential flow option, the boundary layer option, and the parabolic Navier-Stokes option. By sequencing through these options, it is possible to computationally construct a weak-interaction model of the aerodynamic flowfield. This report is the user's guide to operation of COMOC for the aerodynamics sequence. Author

N77-23054*# Numerical Continuum Mechanics, Inc., Woodlawn Hills, Calif.

COMPUTATION OF VISCOUS TRANSONIC FLOW ABOUT A LIFTING AIRFOIL

L. Walitt and C. Y. Liu Nov. 1976 93 p refs

(Contract NAS2-9052)

(NASA-CR-151999; NCMR-76-100) Avail: NTIS HC A05/MF A01 CSCL 01A

The viscous transonic flow about a stationary body in free air was numerically investigated. The geometry chosen was a symmetric NACA 64A010 airfoil at a freestream Mach number of 0.8, a Reynolds number of 4 million based on chord, and angles of attack of 0 and 2 degrees. These conditions were such that, at 2 degrees incidence unsteady periodic motion was calculated along the aft portion of the airfoil and in its wake. Although no unsteady measurements were made for the NACA 64A010 airfoil at these flow conditions, interpolated steady measurements of lift, drag, and surface static pressures compared favorably with corresponding computed time-averaged lift, drag, and surface static pressures. Author

N77-23055*# Rockwell International Corp., Los Angeles, Calif. Aircraft Div.

SPANWISE VARIATION OF POTENTIAL FORM DRAG

W. C. Clever 18 May 1977 116 p refs

(Contract NAS1-14108)

(NASA-CR-145180) Avail: NTIS HC A06/MF A01 CSCL 01A

The finite element method is used to calculate the spanwise variation of potential form drag of a wing at subsonic and supersonic speeds using linearly varying panels. The wing may be of arbitrary planform and nonplanar provided the wing panels are parallel to the aircraft axis. Author

N77-23056*# Goodyear Aerospace Corp., Akron, Ohio.

FEASIBILITY STUDY OF MODERN AIRSHIPS, PHASE 2. VOLUME 1: HEAVY LIFT AIRSHIP VEHICLE. BOOK 1: OVERALL STUDY RESULTS Final Report

Sep. 1976 186 p refs

(Contract NAS2-8643)

(NASA-CR-151917) Avail: NTIS HC A09/MF A01 CSCL 01C

A Heavy Lift Airship combining buoyant lift derived from a conventional helium-filled non-rigid airship hull with propulsive lift derived from conventional helicopter rotors was investigated. The buoyant lift essentially offsets the empty weight of the vehicle; thus the rotor thrust is available for useful load and to maneuver and control the vehicle. Such a vehicle is capable of providing a quantum increase in current vertical lifting capability. Certain critical deficiencies of past airships are significantly minimized or eliminated. Author

N77-23057*# Goodyear Aerospace Corp., Akron, Ohio.

FEASIBILITY STUDY OF MODERN AIRSHIPS, PHASE 2. VOLUME 2: HEAVY LIFT AIRSHIP VEHICLE. BOOK 2: APPENDIXES TO BOOK 1

Sep. 1976 142 p refs

(Contract NAS2-8643)

(NASA-CR-151918) Avail: NTIS HC A07/MF A01 CSCL 01C

For abstract, see N77-23056.

N77-23058*# Goodyear Aerospace Corp., Akron, Ohio.

FEASIBILITY STUDY OF MODERN AIRSHIPS, PHASE 2. VOLUME 1: HEAVY LIFT AIRSHIP VEHICLE. BOOK 3: AERODYNAMIC CHARACTERISTICS OF HEAVY LIFT AIRSHIP AS MEASURED AT LOW SPEEDS Final Report

J. N. Neilsen, O. J. McMillan, S. C. McIntosh, Jr., S. B. Spangler, and J. P. Woolley Sep. 1976 341 p refs Prepared by Nielsen Eng. and Res., Inc., Mountain View, Calif.

(Contract NAS2-8643)

(NASA-CR-151919; NEAR-TR-119-Vol-1-Bk-3) Avail: NTIS HC A15/MF A01 CSCL 01C

Aerodynamic characteristics, for the powered case are considered. The interference effects between rotors and hull are of particular interest. Accordingly, the present tests were carried out for the purposes of exploring the aerodynamic phenomena of the heavy lifter and of obtaining as much data as possible on rotor-hull interference. Aerodynamic results are given together with a hull-rotor interference model for hover. Author

N77-23059*# Goodyear Aerospace Corp., Akron, Ohio.

FEASIBILITY STUDY OF MODERN AIRSHIPS, PHASE 2. VOLUME 2: AIRPORT FEEDER VEHICLE

Sep. 1976 234 p refs

(Contract NAS2-8643)

(NASA-CR-151920) Avail: NTIS HC A11/MF A01 CSCL 01C

The Airport Feeder vehicle is a VTOL, semi-buoyant ellipsoidal airship capable of transporting passengers or cargo to major CTOL hub terminals from suburban and downtown depots. Six tasks were reviewed: (1) vehicle design definition, (2) operational procedures analysis, (3) cost analysis, (4) comparison with alternate transportation modes, (5) mission/vehicle feasibility assessment, and (6) technology assessment. Author

N77-23060*# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.

BOUNDARY LAYER SEPARATION ON ISOLATED BOATTAIL NOZZLES M.S. Thesis

William Kelly Abeyounis 8 May 1977 75 p refs Sponsored by NASA

(NASA-CR-152703) Avail: NTIS HC A04/MF A01 CSCL 01A

The phenomenon of separated flow on a series of circular-arc afterbodies was investigated using the Langley 16-foot transonic tunnel at free-stream Mach numbers from 0.40 to 0.95 at 0 deg angle of attack. Both high-pressure air and solid circular cylinders with a diameter equal to the nozzle exit diameter were used to simulate jet exhausts. A detailed data base of boundary layer separation locations was obtained using oil-flow techniques. The results indicate that boundary layer separation is most extensive on steep boattails at high Mach numbers. Author

N77-23061*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

TAIL CONTRIBUTION TO THE DIRECTIONAL AERODYNAMIC CHARACTERISTICS OF A 1/6-SCALE MODEL OF THE ROTOR SYSTEMS RESEARCH AIRCRAFT WITH A TAIL ROTOR

Raymond E. Mineck (Army Air Mobility Res. and Develop. Lab., Hampton, Va.) Washington May 1977 41 p refs
(DA Proj. 1F1-61102-AH-45)
(NASA-TM-X-3501; L-11271) Avail: NTIS HC A03/MF A01 CSCL 01A

The results are presented of a wind tunnel investigation to determine the tail contribution to the directional aerodynamic characteristics of a 1/6-scale model of the rotor systems research aircraft (RSRA) with a tail rotor. No main rotor was used during the investigation. Data were obtained with and without the tail rotor over a range of sideslip angle and over a range of rotor collective pitch angle. The model with the tail rotor was tested at several advance ratios with and without thrust from the auxiliary thrust engines on the RSRA fuselage. Increasing the space between the tail-rotor hub and the vertical tail reduced the tail-rotor torque required at moderate to high rotor thrust. Increasing the exit dynamic pressure of the auxiliary thrust engines decreases the tail contribution to the static directional stability. The tail-rotor thrust and its interference provide a positive increment to the static directional stability. The tail contribution increases with forward speed. The adverse yawing moment of the airframe would strongly affect the thrust required of the tail rotor when the helicopter is hovering in a crosswind. Author

N77-23062# Virginia Polytechnic Inst. and State Univ., Blacksburg.

ANALYSIS OF TRANSONIC NORMAL SHOCK-BOUNDARY LAYER INTERACTION AND COMPARISONS WITH EXPERIMENT Interim Report

G. R. Inger Aug. 1976 97 p refs Presented at the 9th AIAA Fluid and Plasma Dyn. Meeting, San Diego, Jul. 1976
(Contract N00014-75-C-0456)
(AD-A030350; VPI-AERO-053) Avail: NTIS HC A05/MF A01 CSCL 20/4

An analytical theory for non-separation transonic interactions is described. The theory is an approximate multi-layered model leading to a mixed transonic rotational small disturbance flow boundary value problem solved by Fourier transformation methods. Among the results discussed are: (1) a parametric study of Reynolds number effects yielding universal incipient separation curves for weak normal shock interactions; (2) upstream influence and boundary layer thickening; (3) lateral pressure gradient effects and post-shock expansion regions; and (4) detailed comparisons with pressure distribution data from both channel flow experiments and supercritical wing test data. Author

N77-23063# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.

AEROELASTIC CHARACTERISTICS OF A CIRCULATION CONTROL WING Final Report, Jan. 1974 - Jul. 1975

Joseph B. Wilkerson Sep. 1976 136 p refs
(AD-A033328; DTNSRDC/ASED-1219; DTNSRDC-76-0115) Avail: NTIS HC A07/MF A01 CSCL 01/3

Static aeroelasticity is examined for a wing with circulation control (CC) airfoils. The airfoils use tangential blowing over a rounded trailing edge to provide a lift augmentation proportional to the jet momentum of the blown air. Airfoil lift and pitching moment magnitudes are dependent on both angle of attack and jet momentum. In combination with an elastic structure, this double dependence of lift and moment lead to a CC reversal condition, which is analogous to aileron reversal. Increases in jet momentum beyond the reversal point result in lift decreases. Boundaries for torsional divergence and CC reversal are theoretically examined for the simple two-dimensional case and then for a three-dimensional wing. The wing analysis uses a modified lifting line theory and two-dimensional CC airfoil data to evaluate the behavior of a circulation control wing (CCW). GRA

N77-23064# Tennessee Univ. Space Inst., Tullahoma. Space Inst.

EXPERIMENTAL STUDY ON HIGH SUBSONIC TURBULENT FLOW INCIPIENT SEPARATION

Jain Ming Wu and Hideki Kuwano Jun. 1976 63 p refs
(AD-A032712; RD-CR-76-4) Avail: NTIS HC A04/MF A01 CSCL 20/4

For flow over a two-dimensional ramp compression corner case, an experimental investigation to determine the incipient separation was carried out at Mach numbers between 0.55 and 0.9 and Reynolds numbers (based on undisturbed boundary layer thickness) between 350,000 and 690,000. Detailed surface pressure, pitot traversing and oil flow data were obtained for each ramp angle case. Two-dimensionality of the ramp compression corners was verified by the surface oil flow. A major finding of this study is that the incipient separation ramp angle is relatively independent of Mach number and Reynolds number within the range studied. The incipient separation ramp angle was found to be about 22.5 degrees. GRA

N77-23065# Naval Intelligence Support Center, Washington, D. C.

THE EFFECT OF WIND TUNNEL FLOW BOUNDARIES ON THE FLOW PAST A WING OF LOW ASPECT RATIO

Yu. F. Usik and V. I. Kholyavko 24 Aug. 1976 13 p refs Transl. into ENGLISH from Samoletostr. Tekh. Vozdush. Flota (USSR), no. 28, 1972 p 3-9
(AD-A032527; NISC-Trans-3836) Avail: NTIS HC A02/MF A01 CSCL 20/4

On the basis of general relationships of the thin body theory, the flow past a thin plane wing of low aspect ratio in a wing tunnel with a circular test section. The corrections to the lift coefficients and position of the wing pressure center are determined by allowing for the boundary constraint effect. The solutions obtained are compared with known formulas for experimental corrections. Author

N77-23066# Naval Intelligence Support Center, Washington, D. C. Translation Div.

LOW-ASPECT-RATIO WING IN A BOUNDED INVISCID FLOW

V. I. Kholyavko and Yu. F. Usik 24 Aug. 1976 11 p refs Transl. into ENGLISH from Samoletostr. Tekh. Vozdush. Flota (USSR), no. 20, 1970 p 3-11
(AD-A032529; NISC-trans-3838) Avail: NTIS HC A02/MF A01 CSCL 02/4

The aerodynamic characteristics of a thin planar wing moving near a solid or free surface (hydrofoil) are determined. Use is made of the thin body theory, whereby the three-dimensional flow past a thin body elongated in the direction of motion is approximately replaced by two-dimensional flow in transverse planes. In the case under consideration, the problem is reduced to the study of the motion of a flat plate near an interface. Author (GRA)

N77-23067# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

THE FLOW STARTING PROCESS IN CONSTANT AREA SUPERSONIC DIFFUSERS IN A LUDWIEG TUBE

Peter E. Merkli and Nesim Abuaf Sep. 1976 56 p refs
(Contract F44620-73-C-0032; AF Proj. 9781)
(AD-A033317; AFOSR-76-1236TR; SR-5) Avail: NTIS HC A04/MF A01 CSCL 20/4

A Ludwieg tube with a diaphragm located either upstream or downstream of the test section was used to investigate starting times of flow. For a downstream diaphragm location the starting times were found to be dependent on the diffuser length, but independent of the initial pressure ratio across nozzle and diffuser, as long as this ratio was low enough to allow supersonic

flow to be established. For the upstream diaphragm location, the starting times were much shorter than those for downstream diaphragm location. In this second situation, the starting times, however, increased with the pressure ratio across the entire nozzle-diffuser section. For both upstream and downstream diaphragm locations the starting times for supersonic flow at the nozzle exit were longer for the longer diffusers. The lowest overall pressure ratio needed for the flow to start was about 1.2 times the value of the optimum operating pressure recovery ratio for steady flow. The latter ratio was found in previous experiments in a smaller continuous wind tunnel with a geometrically similar nozzle and diffuser. The required diffuser length for starting at the optimum pressure ratio corresponds to the expected recovery length of the diffuser as derived from the earlier work with steady flow. GRA

N77-23068# Naval Intelligence Support Center, Washington, D. C. Translation Div.

LIFTING SURFACE IN AN UNSTEADY FLOW NEAR A SCREEN

B. N. Belousov, A. N. Lukashenko, and A. N. Panchenkov 24 Aug. 1976 11 p refs Transl. into ENGLISH from Samoletostroveniye i Tekhn. Vozdushnogo Flota (USSR) no. 18, 1970 p 3-11
(AD-A032528; NISC-Trans-3837) Avail: NTIS HC A02/MF A01 CSCL 20/4

Several major works dealing with the theory of a lifting surface in an unsteady flow with various approximate methods of wing design are now in existence. It is common knowledge that the problem of a thin lifting surface of arbitrary aspect ratio is reduced to two-dimensional integral equations for which there are no closed solutions. One of the important aspects is the study of two-dimensional integral equations using one-dimensional approximations, and obtaining final results for the hydroaerodynamic characteristics of a wing in an unsteady flow on the basis of these equations. GRA

N77-23069# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A PARAMETRIC ANALYSIS OF WINGLET EFFECTS M.S. Thesis

Mitchell D. Cary Dec. 1976 120 p refs
(AD-A034944; GA/MC/76D-5) Avail: NTIS HC A06/MF A01 CSCL 01/3

A two part study was undertaken. In the first part, winglet effects were examined on a variety of wing planforms. A nonplaner lifting surface computer program was used to calculate aerodynamic coefficients including lift, induced drag, wing pitching moment, and wing root bending moment coefficients. Typical cruise flight conditions were examined and the coefficients calculated for the wing alone were compared to those obtained for the wing with winglets installed. The calculations were then repeated as the wing aspect ratio, sweep angle, and dihedral angle were varied. Winglet size and orientation remained constant. The percentage induced drag reduction was found to be the greatest on the wing with the highest aspect ratio and wing sweep angle (27.5% for an aspect ratio 7, 45 deg swept wing). Percentage induced drag reduction increased slightly with increasing positive dihedral angle. The greatest incremental drag reduction occurred with the lowest aspect ratio, highest swept wing. The second study examined the effects of winglet cant angle on induced drag reduction. Winglet cant angle on two separate wings was varied from +3 degrees to -3 degrees in an attempt to find an optimum value. The model used in this analysis ignored viscous effects and indicated that positive cant angles (leading edge inboard) yielded the greatest reductions in induced drag. Author (GRA)

N77-23070# Air Force Eastern Test Range, Patrick AFB, Fla.

ATMOSPHERIC ELECTRICITY AND TETHERED AEROSTATS, VOLUME 1 Final Report, 1 Apr. 1973 - 30 Jun. 1974

Toxey A. Hall (Pan American World Airways, Inc., New York) 11 May 1976 255 p refs
(ARPA Order 2176)
(AD-A034847; AFETR-TR-76-07-Vol-1) Avail: NTIS HC A12/MF A01 CSCL 01/3

The program was conducted for the purpose of determining interaction of tethered balloon systems with atmospheric electricity (particularly lightning) and identifying feasible protective systems. After a brief introductory section math models of effects of tethered balloons on surrounding electrical field are presented. These models are then compared with measurements taken during extensive flight testing. Effects of both well-conducting and poorly-conducting tethers are shown. Section 3 presents a statistical approach to the prediction of lightning strikes to tethered balloons. Section 4 describes results of an extensive series of tests wherein balloon tethered samples, both wire rope and synthetic fiber, are exposed to simulated lightning currents. Section 5 defines systems and techniques for hardening balloon and support equipment and protection of operating personnel. Section 6 and 7 present conclusions and recommendations oriented toward tether materials, grounding and shielding systems, warning devices, and operational concepts. GRA

N77-23071# Air Force Eastern Test Range, Patrick AFB, Fla. Range Measurement Lab.

ATMOSPHERIC ELECTRICITY AND TETHERED AEROSTATS, VOLUME 2 Final Report, 1 Apr. 1973 - 30 Jun. 1974

Donald J. Latham (Miami Univ., Fla.), Edward T. Pierce (Stanford Research Inst., Menlo Park, Calif.), Gary H. Price (Stanford Research Inst., Menlo Park Calif.), and James R. Stahmann (Lightning and Transients Research Inst., Miami Beach, Fla.) 11 May 1976 207 p refs
(Contracts F08606-73-C-0039; F08606-74-C-0034; F08606-73-C-0037; F08606-74-C-0031; ARPA Order 2176)
(AD-A034848; AFETR-TR-76-07-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 01/3

Contents: Atmospheric electrical effects of and on tethered balloon systems; Natural electrical effects on the operation of tethered balloon systems; Lightning protection for a RML tethered balloon system, phase I personnel protection; Lightning protection for a RML tethered balloon system, phases II and III - winch, cable and balloon protection. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N77-23072*# Douglas Aircraft Co., Inc., Long Beach, Calif.

COST/BENEFIT TRADEOFFS FOR REDUCING THE ENERGY CONSUMPTION OF THE COMMERCIAL AIR TRANSPORTATION SYSTEM. VOLUME 1: TECHNICAL ANALYSIS Final Report

E. F. Kraus Jun. 1976 289 p refs 2 Vol.
(Contract NAS2-8618)
(NASA-CR-137923; MDC-J7340-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 05C

The effectiveness and associated costs of operational and technical options for reduced fuel consumption by Douglas aircraft in the domestic airline fleet are assessed. Areas explored include alternative procedures for airline and flight operations, advanced and state of the art technology, modification and derivative configurations, new near-term aircraft, turboprop configuration studies, and optimum aircraft geometry. Data for each aircraft studied is presented in tables and graphs. A.R.H.

N77-23073*# Douglas Aircraft Co., Inc., Long Beach, Calif.

COST/BENEFIT TRADEOFFS FOR REDUCING THE ENERGY CONSUMPTION OF THE COMMERCIAL AIR TRANSPORTATION SYSTEM. VOLUME 2: MARKET AND ECONOMIC ANALYSES Final Report

J. C. VanAbkoude Jun. 1976 374 p refs 2 Vol.
(Contract NAS2-8618)
(NASA-CR-137924; MDC-J7340-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 05C

The impact of the most promising fuel conserving options on fuel consumption, passenger demand, operating costs, and airline profits when implemented into the U.S. domestic and

international airline fleets is assessed. The potential fuel savings achievable in the U.S. scheduled air transportation system over the forecast period, 1973-1990, are estimated. Author

N77-23074# Chicago Area Transportation Study, Ill.
NORTHEASTERN ILLINOIS 1995 AIRPORT SYSTEM: IMPLEMENTATION STUDY/PRIORITY STATEMENT
Jun. 1976 124 p refs Sponsored in part by Dept. of Transportation and Federal Highway Admin.
Avail: NTIS HC A06/MF A01

A recommended 1995 airport system plan for the eight county Chicago-Northwest Indiana Standard Consolidated Area was presented. Four alternative systems and their interrelationship with alternative highway, transit, and freight transportation plans were examined. B.B.

N77-23075# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
A MID-AIR COLLISION THREAT ALGORITHM THAT USES BEARING DATA Final Report, Aug. - Oct. 1976
Irwin W. Kay Nov. 1976 55 p refs
(AD-A033617; P-1231; IDA/HQ-76-18690) Avail: NTIS HC A04/MF 01 CSCL 01/2

This paper derives an algorithm for use by an airborne mid-air collision avoidance system to determine when an alarm should be given in case a mid-air collision is imminent. The algorithm is based on an extension of the standard modified tau alarm criterion used in most collision avoidance system threat logics. The standard criterion uses only altitude and range data and, as a result, will generate high alarm rates in heavy air traffic. The criterion presented here makes use of bearing data as well as altitude and range data and should, therefore, provide lower alarm rates. Author (GRA)

N77-23076# Air Force Civil Engineering Center, Tyndall AFB, Fla.
THE REDUCTION OF F-111 LOW-LEVEL ENROUTE BIRD HAZARDS Final Report
Dennis E. Compton Mar. 1976 26 p refs
(AD-A032879; AFCEC-TR-76-11) Avail: NTIS HC A03/MF A01 CSCL 01/2

The F-111 aircraft has experienced a serious bird strike hazard because of its high-speed, low-level flying mission. This report examines the possible solutions and associated problems related to reducing enroute bird hazards. Four methods are discussed: (1) route studies to determine the relationship of habitat to species abundance and occurrence, (2) the use of radar to detect migratory movements, (3) formulation of a migration prediction model, and (4) determination of scheduling adjustments to coincide with low bird density and reduced activity. The success of any of the proposed methods is dependent upon the mission flexibility and available training alternatives at a given base. Results of the study may also apply to reducing bird strikes at Air Training Command student pilot training bases and to determine minimum bird hazards for proposed low-level routes for the B-1 Bomber. Author (GRA)

N77-23077# Naval Weapons Center, China Lake, Calif.
BASELINE DATA FROM AN A-4 COCKPIT IN SIMULATED CARRIER DECK FIRE Technical Publication, FY 1975 - 1976
Anthony SanMiguel Aug. 1976 146 p refs
(AD-A034217; NWC-TP-5812) Avail: NTIS HC A07/MF A01 CSCL 01/3

This report describes a study that was designed to gather fundamental data on the survivability of an aircraft cockpit in a carrier deck fire, on the characteristics of cockpit structural degradation in the fire, and on various interacting mechanisms that reduce a pilot's functionability. An unarmed Navy A-4 cockpit was subjected to a simulated carrier deck pool fire. The cockpit was instrumented with transducers to measure temperature, heat, smoke, toxic gases, light, shock, sound, pressure, and physiological behavior of rats and mice. A number of appendixes to the report give detailed descriptions of the various measuring systems and the data they produced. In addition to providing much immediately useful data, the test yielded a good base of data on which to design future tests of this kind. Author (GRA)

N77-23078# Air Force Human Resources Lab., Brooks AFB, Tex.
EFFECTIVENESS OF SMOKE ABATED TRAINING IN SIMULATED CRASH FIRE FIGHTING Final Report, Jun. 1974 - Jun. 1976
Brian E. Dallman and Philip J. DeLeo Aug. 1976 40 p refs (AF Proj. 1121)
(AD-A034843; AFHRL-TR-76-60) Avail: NTIS HC A03/MF A01 CSCL 05/9

Concern for the environment has resulted in the development of a water spray apparatus which can greatly reduce the smoke associated with aircraft crash fire simulations used in fire fighter training. This study compared the effectiveness of smoke abated training with conventional procedures. Results showed no significant differences between students trained under smoke abated conditions and those who experienced natural, or smoky, fires during training. However, students who had received smoke abated training were less confident and more unsure of the effectiveness of their training than conventional students. It was concluded that smoke abated training can be an effective method for training fire protection specialists with certain constraints. Recommendations regarding employment of the smoke suppression apparatus are provided in the report. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N77-23079# National Aviation Facilities Experimental Center, Atlantic City, N. J.
TEST AND EVALUATION OF AN ENROUTE SYSTEM TERRAIN-AVOIDANCE FUNCTION WITH THE NAS A3d2.1 SYSTEM Interim Report, Dec. 1975 - Jun. 1976
Frederick W. Ranger Feb. 1977 15 p
(AD-A036441; FAA-NA-76-35; FAA-RD-77-14) Avail: NTIS HC A02/MF A01 CSCL 17/7

The operational evaluation of an enroute system terrain-avoidance function in conjunction with the National Airspace System Enroute A3d2.1 system is described. Tests were conducted in a low-altitude environment with simulated digital target data. Tests were designed to evaluate the performance of the terrain-avoidance function with respect to detection capability and adequacy of warning provided. Results indicate that although the terrain-avoidance function performed adequately for most enroute situations, false or late alerts could occur, due to the lag between the terrain-avoidance vector line and true aircraft heading. Author

N77-23080# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
EXPERIMENTAL RESEARCH ON THE PROPAGATION OF LORAN-C SIGNALS. VOLUME A: SUMMARY REPORT
L. F. Fehlner, T. W. Jerardi, T. A. McCarty, and R. G. Roll Oct. 1976 77 p refs 4 Vol.
(Contract N00017-72-C-4401)
(AD-A034193; APL/JHU-TG-1298-Vol-A) Avail: NTIS HC A05/MF A01 CSCL 17/7

One facet of the theory of groundwave propagation at 100 kHz was determined. It was determined if an analytic function could be developed for operational use that relates secondary phase factor (SPF) to envelope-to-cycle difference (ECD) so that geodetic position can be computed accurately and in real time. Field test data were collected and analyzed and show trends that tend to support the hypothesis that the desired functional relationship exists, at least under certain conditions. Author

N77-23081# Mitre Corp., Bedford, Mass.
STEREOGRAPHIC PROJECTION IN THE JOINT SURVEILLANCE SYSTEM

C. H. Nordstrom Sep. 1976 72 p refs
(Contract F19628-76-C-0001; AF Proj. 6620)
(AD-A031343; MTR-3225; ESD-TR-76-169) Avail: NTIS HC A04/MF A01 CSCL 17/9

In air defense and air traffic control systems, data from the system radars are stereographically projected onto a common coordinate plane for presentation to system operators. The stereographic projection of radar data involves two steps: stereographic projection using slant range, azimuth and height information to obtain polar coordinates in a plane of projection centered at the radar site, and transformation of the radar coordinates into cartesian coordinates on a common coordinate plane. This report describes analysis that was performed on the stereographic projection process. The results indicate that the SAGE/BUIC equations for stereographic ground range produce unacceptably large registration errors when extended to a large region. The results further indicate that the error can be corrected by a simple modification of the SAGE/BUIC equations. GRA

N77-23082# Litton Systems, Inc., Woodland Hills, Calif. Guidance and Control Systems Div.
NO-DROP WEAPON SCORING STUDY Final Report
J. S. Ausman Aug. 1976 66 p refs
(Contract N00173-76-C-0247)
(AD-A031519; G/CSD-403343; NRL-76-001) Avail: NTIS HC A04/MF A01 CSCL 17/7

This report summarizes the results of a No-Drop Weapon Scoring (NDWS) study performed by Litton Guidance and Control Systems. The report contains a description of the impact prediction process and its accuracy in terms of sensitivities to measurement errors. Setting these impact prediction errors equal to the expected ballistic dispersion yields a set of acceptable measurement error tolerances. The study discusses mechanization of an NDWS to obtain these measurement accuracies. A summary description of an Airborne Range Instrumentation System (ARIS), along with flight test results, is included as an example of satisfactory mechanization. Author (GRA)

N77-23083# Federal Aviation Administration, Washington, D. C. Office of Management Systems.
FAA AIR TRAFFIC ACTIVITY, FISCAL YEAR 1976 Semiannual Report
George Thompson and Patricia Wilson 30 Jun. 1976 247 p
(AD-A032260) Avail: NTIS HC A11/MF A01 CSCL 17/7

This report furnishes terminal and enroute air traffic activity information of the National Airspace System. The data have been reported by the FAA-operated Airport Traffic Control Towers (ATCTs), Air Route Traffic Control Centers (ARTCCs), Flight Service Stations (FSSs), Combined Station Towers (CS/Ts), International Flight Service Stations (IFSSs), and Approach Control Facilities. Author (GRA)

N77-23084# Air Force Communications Service, Richards-Gebaur AFB, Mo.
AIR TRAFFIC CONTROL RADAR BEACON SYSTEM. SPECIAL EVALUATION REPORT. PEASE AFB, NEW HAMPSHIRE Final Report
David E. Smith 8 Nov. 1976 58 p
(AD-A033068; Rept-75/66S-75) Avail: NTIS HC A04/MF A01 CSCL 17/7

This traffic control and landing systems (TRACALS) radar special evaluation report presents data collected to document the air traffic control radar beacon system (ATCRBS) reflection situation at Pease AFB, New Hampshire. The data presented in this report was collected during the evaluation period 14 to 20 July 1976. This report identifies the sources of reflection and the expected areas of false target display. The information in this report should be used as a source document for a future corrective action to eliminate false targets at Pease AFB as well as other Air Force bases. Author (GRA)

N77-23085# Rome Air Development Center, Griffiss AFB, N.Y.
TRANSIENT SUPPRESSION MODIFICATION FOR INSTRUMENT LANDING SYSTEM AN/GRN-27(V) (SOLID STATE INSTRUMENT LANDING SYSTEM (SSILS)) Final Report
Chester W. Paprocki Oct. 1976 50 p refs
(AD-A033710; RADC-TR-76-265) Avail: NTIS HC A03/MF A01 CSCL 01/2

The Solid State Instrument Landing System (SSILS) AN/GRN-27(v) was experiencing excessive outages during lightning storms, which are the periods of time in which the ILS is in the most critical demand. An in-house study was made of the source and type of transients that were affecting the system. Protective methods and devices were evaluated and protective circuitry was designed. The characteristics of the transient and design criteria for a suitable modification are discussed in the report. GRA

N77-23086# Hawaii Inst. of Geophysics, Honolulu.
GEOID HEIGHTS AND GEODETIC POSITIONS OF PACIFIC HARBORS AND DEEP SEA DRILLING SITES Final Report
Eduard Berg Nov. 1976 143 p refs
(Contract N00014-75-C-0209)
(AD-A034869) Avail: NTIS HC A07/MF A01 CSCL 08/5

A relatively simple double pass method is used to (a) reduce longitudinal spread of satellite navigation fixes and (b) obtain antenna height or sea level height on board a ship in a fixed harbor or fixed open-sea position (over an acoustic beacon). Required are the satellite navigator output or latitude, longitude, elevation angle, and path geometry for two consecutive passes (one east and one west of the site) of the same satellite. The standard deviation of one such double pass observation in a larger data set is usually below 20 m in both longitude and height. Improvements in the position accuracy of a site (as measured by sigma sub m, the standard deviation of the mean or the 95% confidence interval) are obtained by restricting observations to passes: with a high number of symmetric Doppler counts, between given elevation angles, with a small number of iterations of the satellite navigator, and with eliminations of double pass results that are outside specified limits (usually 2 sigma sub m) in height and/or longitude. An accuracy sigma sub m of 10 m or less is usually achieved with four to five days of recordings. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N77-23087*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED WIND-TUNNEL TESTS OF A ONE-TENTH-SCALE MODEL OF A BLENDED-ARROW ADVANCED SUPERSONIC TRANSPORT
H. Clyde Lemore and Lysle P. Parett Mar. 1975 70 p refs
(NASA-TM-X-72671) Avail: NTIS HC A04/MF A01 CSCL 01C

Tests were conducted in the Langley full scale tunnel to determine the low-speed aerodynamic characteristics of a 1/10 scale model of a blended-arrow advanced supersonic transport. Tests were made for the clean configuration and a high-lift configuration with several combinations of leading- and trailing-edge flaps deflected for providing improved lift and longitudinal stability in the landing and takeoff modes. The tests were conducted for a range of angles of attack from about -6 deg to 30 deg, sideslip angles from -5 deg to 10 deg, and for Reynolds numbers from 6.78 x 1,000,000 to 13.85 x 1,000,000 corresponding to test velocities of 41 knots to 85 knots, respectively. Author

N77-23088*# Virginia Univ., Charlottesville. School of Engineering and Applied Science.
DEVELOPMENT OF A RESEARCH PROJECT SELECTION MODEL: APPLICATION TO A CIVIL HELICOPTER RESEARCH PROGRAM Final Report
Michael B. Schoultz and Ira D. Jacobson May 1977 227 p refs
(Grant NsG-1274)
(NASA-CR-152701; UVA/528051/ESS77/102) Avail: NTIS CSCL 01C

A model is described for planning and decision making in research project selection. Evaluations of each project's direct

and indirect benefits, uncertainty in achieving these benefits, and schedule priority with resource budget and program balance constraints are considered. The combination of the interactive effect of project selection, resource allocation and scheduling considerations into one model permits tradeoff alternatives to be studied. Clients' value judgments are used in evaluating the benefits from each proposed project. The model is applied to the NASA Civil Helicopter Technology Program. Research project priorities for this program are established, strengths and weaknesses of the model are discussed, and areas of future development are recommended. Author

N77-23089*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN OF A LARGE SPAN-DISTRIBUTED LOAD FLYING-WING CARGO AIRPLANE
Lloyd S. Jernell and C. Baptiste Quartero (Vought Corp., Hampton, Va.) 22 Apr. 1977 99 p refs
(NASA-TM-X-74031) Avail: NTIS HC A05/MF A01 CSCL 01C

The design and operation of very large, long-range, subsonic cargo aircraft are considered. A design concept which distributes the payload along the wingspan to counterbalance the aerodynamic loads, with a resultant decrease in the in-flight wing bending moments and shear forces, is described. The decreased loading of the wing structure, coupled with the very thick wing housing the cargo, results in a relatively low overall structural weight in comparison to that of conventional aircraft. Author

N77-23090*# McDonnell Aircraft Co., St. Louis, Mo.
STUDY OF A FAIL-SAFE ABORT SYSTEM FOR AN ACTIVELY COOLED HYPERSONIC AIRCRAFT: COMPUTER PROGRAM DOCUMENTATION
L. A. Haas, Sr. [1976] 213 p refs
(Contract NAS1-13631)
(NASA-CR-144927; MDC-A3791) Avail: NTIS HC A10/MF A01 CSCL 01C

The Fail-Safe Abort System TEMPerature Analysis Program, (FASTEMP), user's manual is presented. This program was used to analyze fail-safe abort systems for an actively cooled hypersonic aircraft. FASTEMP analyzes the steady state or transient temperature response of a thermal model defined in rectangular, cylindrical, conical and/or spherical coordinate system. FASTEMP provides the user with a large selection of subroutines for heat transfer calculations. The various modes of heat transfer available from these subroutines are: heat storage, conduction, radiation, heat addition or generation, convection, and fluid flow. Author

N77-23091*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LARGE-SCALE V/STOL TESTING
David G. Koenig, Thomas N. Aiken, Kiyoshi Aoyagi, and Michael D. Falarshi May 1977 16 p refs Prepared in cooperation with Army Air Mobility Research and Development Lab., Moffett Field, Calif.
(NASA-TM-X-73231; A-7002) Avail: NTIS HC A02/MF A01 CSCL 01C

Several facets of large-scale testing of V/STOL aircraft configurations are discussed with particular emphasis on test experience in the Ames 40- by 80-Foot Wind Tunnel. Examples of powered-lift test programs are presented in order to illustrate tradeoffs confronting the planner of V/STOL test programs. Large-scale V/STOL wind-tunnel testing can sometimes compete with small-scale testing in the effort required (overall test time) and program costs because of the possibility of conducting a number of different tests with a single large-scale model where several small-scale models would be required. The benefits of both high- or full-scale Reynolds numbers, more detailed configuration simulation, and number and type of onboard measurements are studied. Author

N77-23092# Royal Aircraft Establishment, Farnborough (England).
INFLUENCE OF LEADING EDGE RADIUS ON THE HIGH DEFLECTION STATOR BLADES
J. Paulon May 1976 26 p refs Transl. into ENGLISH from Bulletin de l'Association Technique Maritime et Aeronautique (Paris), no. 73, 1973 p 485-503
(RAE-Lib-Trans-1896; BR54874) Avail: NTIS HC A03/MF A01

An experimental facility made of an inducer delivering a swirling flow in an annular channel is used for testing stator blade cascades. Pressure rise, deflection and efficiency are measured at mid-radius. By means of varying the upstream total pressure, a wide range of inlet Mach numbers are realized. By changing the inducer, the angles of attack of the test cascades are modified (five different inducers are used). Test results show that leading edge radius controls the off-design characteristics of the stator. The experiments made with the same blades the leading of which are progressively cut-off and the leading edge radius increased give pressure rise and efficiency independent of the leading edge radius but improved deflection for a small but finite leading edge radius. Author

N77-23093*# Lear Siegler, Inc., Los Angeles, Calif. Astronics Div.
THE DEVELOPMENT OF ADVANCED AUTOMATIC FLARE AND DECRAB FOR POWERED LIFT SHORT HAUL AIRCRAFT USING A MICROWAVE LANDING SYSTEM
Geert Gevaert and Ben Feinreich Apr. 1977 278 p
(Contract NAS2-9068)
(NASA-CR-151948) Avail: NTIS HC A13/MF A01 CSCL 01C

Advanced automatic flare and decrab control laws were developed for future powered lift STOL aircraft using the NASA-C-8A augmentor wing vehicle as the aircraft model. The longitudinal control laws utilize the throttle for flight path control and use the direct lift augmentor flap chokes for flight path augmentation. The elevator is used to control airspeed during the approach phase and to enhance path control during the flare. The forward slip maneuver was selected over the flat decrab technique for runway alignment because it can effectively handle the large crab angles obtained at STOL approach speeds. Performance evaluation of selected system configurations were obtained over the total landing environment. Limitations were defined and critical failure modes assessed. Pilot display concepts are discussed. Author

N77-23094*# Boeing Vertol Co., Philadelphia, Pa.
A MATHEMATICAL SIMULATION MODEL OF A 1985-ERA TILT-ROTOR PASSENGER AIRCRAFT
Michael A. McVeigh and C. A. Widdison Aug. 1976 244 p refs
(Contract NAS2-8048)
(NASA-CR-151949; D238-10002-1) Avail: NTIS HC A11/MF A01 CSCL 01C

A mathematical model for use in real-time piloted simulation of a 1985-era tilt rotor passenger aircraft is presented. The model comprises the basic six degrees-of-freedom equations of motion, and a large angle of attack representation of the airframe and rotor aerodynamics, together with equations and functions used to model turbine engine performance, aircraft control system and stability augmentation system. A complete derivation of the primary equations is given together with a description of the modeling techniques used. Data for the model is included in an appendix. Author

N77-23095*# Boeing Vertol Co., Philadelphia, Pa.
PRELIMINARY SIMULATION OF AN ADVANCED, HINGLESS ROTOR XV-15 TILT-ROTOR AIRCRAFT
M. A. McVeigh Dec. 1976 391 p refs
(Contract NAS2-8048)
(NASA-CR-151950; D210-11161-1) Avail: NTIS HC A17/MF A01 CSCL 01C

The feasibility of the tilt-rotor concept was verified through investigation of the performance, stability and handling qualities of the XV-15 tilt rotor. The rotors were replaced by advanced-technology fiberglass/composite hingless rotors of larger diameter, combined with an advanced integrated fly-by-wire control system. A parametric simulation model of the HRXV-15 was developed, model was used to define acceptable preliminary ranges of primary and secondary control schedules as functions of the flight parameters, to evaluate performance, flying qualities and structural loads, and to have a Boeing-Vertol pilot conduct a simulated flight test evaluation of the aircraft. Author

N77-23096*# Cessna Aircraft Co., Wichita, Kans. Pawnee Div.

CONCEPTUAL DESIGN OF A SINGLE TURBOFAN ENGINE POWERED LIGHT AIRCRAFT

Michael Newman and George L. Huggins 31 Mar. 1977 139 p refs

(Contract NAS2-9243)

(NASA-CR-151973; AD-200) Avail: NTIS HC A07/MF A01 CSCL 01C

The NASA developed General Aviation Synthesis Program (GASP) was evaluated as to its usefulness as a design tool. This evaluation was accomplished by conducting a conceptual study of a Cessna designed turbofan aircraft using Cessna's sizing routines and the GASP, and comparing the GASP methodology to the design procedures now in use by Cessna. This evaluation concluded that the GASP needs extensive modifications to fulfill its purpose; but once these are made the program could be a useful new tool for general aviation. Author

N77-23097*# Systems Technology, Inc., Mountain View, Calif.

AIRWORTHINESS CRITERIA DEVELOPMENT FOR POWERED-LIFT AIRCRAFT: A PROGRAM SUMMARY

Robert K. Heffley, Robert L. Stapleford, and Robert C. Rumold Washington NASA Feb. 1977 316 p refs Sponsored in part by FAA

(Contract NAS2-7926)

(NASA-CR-2791; FAA-RD-76-195; STI-TR-1047-4) Avail: NTIS HC A14/MF A01 CSCL 01C

A four-year simulation program to develop airworthiness criteria for powered-lift aircraft is summarized. All flight phases affected by use of powered lift (approach, landing, takeoff) are treated with regard to airworthiness problem areas (limiting flight conditions and safety margins: stability, control, and performance; and systems failure). The general features of powered-lift aircraft are compared to conventional aircraft.

Author

N77-23098*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EMPIRICAL COMPARISON OF A FIXED-BASE AND A MOVING-BASE SIMULATION OF A HELICOPTER ENGAGED IN VISUALLY CONDUCTED SLALOM RUNS

Russell V. Parrish, Jacob A. Houck, and Dennis J. Martin, Jr. (Sperry Rand Corp., Hampton, Va.) Washington May 1977 33 p refs

(NASA-TN-D-8424; L-11275) Avail: NTIS HC A03/HC A01 CSCL 01C

Combined visual, motion, and aural cues for a helicopter engaged in visually conducted slalom runs at low altitude were studied. The evaluation of the visual and aural cues was subjective, whereas the motion cues were evaluated both subjectively and objectively. Subjective and objective results coincided in the area of control activity. Generally, less control activity is present under motion conditions than under fixed-base conditions, a fact attributed subjectively to the feeling of realistic limitations of a machine (helicopter) given by the addition of motion cues. The objective data also revealed that the slalom runs were conducted at significantly higher altitudes under motion conditions than under fixed-base conditions. Author

N77-23099# Neilsen Engineering and Research, Inc., Mountain View, Calif.

PREDICTION OF SUPERSONIC STORE SEPARATION CHARACTERISTICS. VOLUME 1: THEORETICAL METHODS AND COMPARISONS WITH EXPERIMENT Final Report, 24 Feb. 1975 - 24 Mar. 1976

Marnix F. E. Dillenius, Frederick K. Goodwin, and Jack N. Nielsen May 1976 162 p refs

(Contract F33615-75-C-3053)

(AD-A031828; NEAR-TR-105; AFFDL-TR-76-41-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 01/3

The primary objective of this report is to describe an investigation to develop a method for predicting the separation characteristics of a store released from a supersonic parent aircraft. The present computer program is designed to handle configurations consisting of a wing without dihedral or incidence which is attached to an axisymmetric fuselage. A pylon can be attached to the wing or under the fuselage. In this work, supersonic flow models are described to represent the configuration and special attention is given to the flow field calculation method. It is shown that the basic method utilizing linear, potential flow theory must be corrected for nonlinear effects caused by the shock from the wing leading edge. Experimental results are presented from a wind-tunnel test program designed to provide data to aid in developing and testing the theory. Comparisons between theory and experiment for flow fields, store loading distributions and store forces and moments indicate fair to very good agreement. Recommendations are given for improving the present method.

Author (GRA)

N77-23100# Neilsen Engineering and Research, Inc., Mountain View, Calif.

PREDICTION OF SUPERSONIC STORE SEPARATION CHARACTERISTICS. VOLUME 2: USERS MANUAL FOR THE COMPUTER PROGRAM Final Report, 24 Feb. 1975 - 24 Mar. 1976

Frederick K. Goodwin, Mary M. Keirstead, and Marnix F. E. Dillenius May 1976 274 p refs 2 Vol.

(Contract F33615-75-C-3053; AF Proj. 8219)

(AD-A031388; NEAR-TR-106; AFFDL-TR-76-41-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 01/3

Detailed instructions are presented for using a computer program which calculates the six-degree-of-freedom trajectories of external stores which are separated from fighter-bomber type aircraft flying at supersonic speeds. Single store configurations can be handled by the program. The program uses linear potential-flow theory to model the wing and pylon loading and thickness. Three-dimensional line sources and line doublets are used to model the fuselage and store. The program also calculates the trajectory of the store as it separates from the aircraft. This report describes the program, presents instructions for preparing input for the program, describes the output from the program, and presents a sample case. The program draws heavily on an earlier program for subsonic speeds written by the present authors and described in AFFDL-TR-74-130. Author (GRA)

N77-23101# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Aerospace Power Div.

LIFE TEST OF A DYNAVECTOR ROTARY ACTUATOR FOR AIRCRAFT HYDRAULIC SYSTEMS Final Report, Jul. 1971 - Mar. 1976

Kenneth E. Binns Oct. 1976 53 p ref

(AF Proj. 3145)

(AD-A033784; AFAPL-TR-76-58) Avail: NTIS HC A04/MF A01 CSCL 01/3

This report describes the testing of a hydraulic rotary actuator concept developed by Bendix Research Laboratories under a previous AF R and D contract. The testing included 326 hours and over 400,000 cycles on the actuator. The actuator was designed for a stall torque of 100,000 in-lb at a 3000 psi differential pressure. A discussion of the problems encountered during this program and an inspection analysis of the actuator after testing are included in this report. Author (GRA)

N77-23102# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A STUDY OF THE METHOD OF SURFACE FIT APPROXIMATIONS FOR AIRCRAFT OPTIMAL DESIGN M.S. Thesis

Martin L. Marler Oct. 1976 72 p refs

(AD-A034878; GA/MC/76D-9) Avail: NTIS HC A04/MF A01 CSCL 01/3

A study was made to demonstrate the feasibility of using surface fit approximations in the design analysis of an advanced tactical fighter. Design variables were selected and a design space was defined based on a simple latin square method. The take-off-gross-weight (TOGW) and landing distance (DISTL) for each configuration were determined by use of a computer program which simulated the required mission. A regression analysis was performed on this data to obtain a quadratic surface fit representing TOGW and DISTL as functions of the design variables. A conjugate gradient technique was employed to find the minimum TOGW subject to constraints on DISTL within the design space. This value was compared to the minimum obtained by running all possible combinations of design variables through the mission simulator. It was concluded that the surface fit approximation

based on the latin square design space did yield accurate results and required fewer computer simulations. Author (GRA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N77-23103# Defense Systems Management School, Fort Belvoir, Va.

USE OF COMMERCIAL OFF-THE-SHELF EQUIPMENT IN MILITARY AIRCRAFT

Donald L. Scott May 1976 36 p refs

(AD-A033818) Avail: NTIS HC A03/MF A01 CSCL 01/3

The goals of the project were to identify and evaluate the documents controlling the performance, environmental testing and reliability testing of commercial avionics equipment, and to compare these procedures with conventional military practice, and to analyze and highlight those factors which impact the decision of an acquisition program manager who is considering the use of commercial equipment in military aircraft. GRA

N77-23104# Hughes Aircraft Co., Culver City, Calif.

FUNCTION AND CONFIGURATION ANALYSIS PROGRAM Final Report, 1 May - 31 Oct. 1975

Millard H. Martin and H. H. Rosengard Oct. 1976 93 p

(Contract F33615-75-C-1270; AF Proj. 6096)

(AD-A034206; AFAL-TR-76-122) Avail: NTIS HC A04/MF A01 CSCL 09/5

The objective of the effort is to perform studies to investigate the feasibility, practicality, and implementation of standard electronics modules (SEM) for avionics. Tradeoff studies are used to provide quantitative data to assist the Air Force Engineers in selecting the SEM format(s) in a timely fashion. This report describes the details of the study with conclusions made and recommendations for future work to be considered. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N77-23105 Committee on Public Works and Transportation (U. S. House).

CURRENT AND PROPOSED FEDERAL POLICY ON THE ABATEMENT OF AIRCRAFT NOISE

Washington GPO 1976 1449 p refs Hearings before the Subcomm. on Aviation of the Comm. on Public Works and Transportation, 94th Congr., 1st and 2d Sess., 2-4, 10-11 Dec. 1975; 20-21, 27-29 Jan. 1976; 10-11, 17, 24-26 Feb. 1976; 5 and 26 Mar. 1976

(GPO-67-373) Avail: Subcomm. on Aviation

The effects of aircraft noise, and its regulation and reduction are discussed in testimony heard and materials received for the record between Dec. 2, 1975 and March 26, 1976. Noise certification requirements for specific classes of aircraft under FAR 36 are examined, and their applicability to military aircraft explored. A.R.H.

N77-23106* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OIL COOLING SYSTEM FOR A GAS TURBINE ENGINE Patent

George A. Coffinberry (GE, Cincinnati) and Howard B. Kast, inventors (to NASA) (GE, Cincinnati) Issued 3 May 1977 9 p Filed 4 Feb. 1976 Division of US Patent Appl. SN-596641, filed 17 Jul. 1975 Sponsored by NASA

(NASA-Case-LEW-12830-1; US-Patent-4,020,632; US-Patent-Appl-SN-655149; US-Patent-Class-60-39.03; US-Patent-Class-60-39.28R; US-Patent-Class-60-39.66; US-Patent-Class-415-180; US-Patent-Class-123-41.33; US-Patent-Class-123-122E; US-Patent-Class-137-101; US-Patent-Appl-SN-596641) Avail: US Patent Office CSCL 21E

A gas turbine engine fuel delivery and control system is provided with means to recirculate all fuel in excess fuel control requirements back to the aircraft fuel tank. This increases the fuel pump heat sink and decreases the pump temperature rise without the addition of valving other than normally employed. A fuel/oil heat exchanger and associated circuitry is provided to maintain the hot engine oil in heat exchange relationship with the cool engine fuel. Where anti-icing of the fuel filter is required, means are provided to maintain the fuel temperature entering the filter at or above a minimum level to prevent freezing thereof. In one embodiment, a divider valve is provided to take all excess fuel from either upstream or downstream of the fuel filter and route it back to the tanks, the ratio of upstream to downstream extraction being a function of fuel pump discharge pressure.

Official Gazette of the U.S. Patent Office

N77-23107+ Wetenschappelijk en Technisch Documentatie- en Informatiecentrum voor de Krijgsmacht, The Hague (Netherlands).

ON THE MAINTENANCE OF AIRCRAFT ENGINES. A BIBLIOGRAPHY, 1968 - 1975

O. VanVeen, (comp.) Feb. 1976 88 p refs Partly in DUTCH, FRENCH, GERMAN, and ENGLISH

(TDCK-67505) Avail: NTIS HC A05

One hundred fifty-eight abstracts of articles published in scientific periodicals and reports available at the TDCK on maintaining aircraft engines are presented. The main subjects covered are engine control monitoring, engine failure detection, and general maintenance. ESA

N77-23108*# Hamilton Standard, Windsor Locks, Conn.

VARIABLE PITCH FAN SYSTEM FOR NASA/NAVY RESEARCH AND TECHNOLOGY AIRCRAFT

W. P. Ryan, D. M. Black, and A. F. Yates Apr. 1977 29 p

(Contract NAS3-20033)

(NASA-CR-135185) Avail: NTIS HC A03/MF A01 CSCL 21E

Preliminary design of a shaft driven, variable-pitch lift fan and lift-cruise fan was conducted for a V/STOL Research and Technology Aircraft. The lift fan and lift-cruise fan employed a common rotor of 157.5 cm diameter, 1.18 pressure ratio variable-pitch fan designed to operate at a rotor-tip speed of 284 mps. Fan performance maps were prepared and detailed aerodynamic characteristics were established. Cost/weight/risk trade studies were conducted for the blade and fan case. Structural sizing was conducted for major components and weights determined for both the lift and lift-cruise fans. Author

N77-23109*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NASA QUIET CLEAN GENERAL AVIATION TURBOFAN (QCGAT) PROGRAM STATUS

D. L. Bresnahan and G. K. Sievers 1977 23 p Presented at Intern. Gas Turbine Conf., Philadelphia, Pa., 27-31 Mar. 1977; sponsored by ASME

(NASA-TM-X-73564; E-9008) Avail: NTIS HC A02/MF A01 CSCL 21E

The suitability of large engine technology to reduce noise, emissions, and fuel consumption of small turbine engines and develop new technology where required is determined. The design, fabrication, assembly, test, and delivery of the experimental engines to NASA are discussed. Author

N77-23110*# Rockwell International Corp., Los Angeles, Calif. Aircraft Div.

SMALL-SCALE TEST PROGRAM TO DEVELOP A MORE EFFICIENT SWIVEL NOZZLE THRUST DEFLECTOR FOR V/STOL LIFT/CRUISE ENGINES

Donald W. Schlundt Nov. 1976 112 p

(Contract NAS2-8972)

(NASA-CR-151956; NA-76-863) Avail: NTIS HC A06/MF A01 CSCL 21E

The installed performance degradation of a swivel nozzle thrust deflector system obtained during increased vectoring angles of a large-scale test program was investigated and improved. Small-scale models were used to generate performance data for analyzing selected swivel nozzle configurations. A single-swivel nozzle design model with five different nozzle configurations and a twin-swivel nozzle design model, scaled to 0.15 size of the large-scale test hardware, were statically tested at low exhaust pressure ratios of 1.4, 1.3, 1.2, and 1.1 and vectored at four nozzle positions from 0 deg cruise through 90 deg vertical used for the VTOL mode. Author

N77-23111*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYSIS OF CONTROL CONCEPTS FOR GAS AND SHAFT-COUPLED V/STOL AIRCRAFT LIFT FAN SYSTEMS

James F. Sellers, Clint E. Hart, and James R. Mihaloew 1977 21 p refs Presented at V/STOL Conf., Palo Alto, Calif., 6-8 Jun. 1977; sponsored by AIAA

(NASA-TM-X-73611; E-9094) Avail: NTIS HC A02/MF A01 CSCL 21E

For lift-fan powered V/STOL aircraft, two unconventional propulsion system types were proposed. The first type uses fans connected by hot gas ducting, and the second type uses fans connected by cross shafting. An analytical study identified the basic steady-state and dynamic characteristics for each type of system. For the gas-coupled system, the control concepts analyzed were variable-area fan turbines and throttling valves in the ducting. For the shaft-coupled system, the control concepts analyzed were variable-pitch fans and variable fan inlet guide vanes. All of these concepts are capable of meeting V/STOL aircraft control moment and transient response requirements when appropriate propulsion controls are used. Author

N77-23112*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MINIMUM-TIME ACCELERATION OF AIRCRAFT TURBOFAN ENGINES

Fred Teren 1977 16 p refs Presented at Joint Automatic Control Conf., San Francisco, 22-24 Jun. 1977

(NASA-TM-X-73624; E-9115) Avail: NTIS HC A02/MF A01 CSCL 21E

Minimum-time accelerations of the F100 turbofan engine are presented. A piecewise-linear engine model, having three state variables and four control variables, is used to obtain the minimum-time solutions. The linear model which applies at a given time in the trajectory is determined by calculating a normalized distance from the current state to the equilibrium state associated with each linear model. The linear model associated with the closest equilibrium point is then used. The control histories for the minimum-time solutions are used as input to a nonlinear simulation of the F100 engine to verify the accuracy of the piecewise linear solutions. Author

N77-23113*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

STALLED AND STALL-FREE PERFORMANCE OF AXIAL-FLOW COMPRESSOR STAGE WITH THREE INLET-GUIDE-VANE AND STATOR-BLADE SETTINGS

Donald C. Urasek, Ronald J. Steinke, and Walter S. Cunnan Washington May 1977 16 p refs

(NASA-TN-D-8457; E-8222) Avail: NTIS HC A02/MF A01 CSCL 21E

The performance of the first stage of a transonic, multistage compressor was mapped over a range of inlet-guide-vane and stator-blade settings. Both stall-free and deep-stall performance data were obtained. For the settings tested, as stall was encountered and flow was further reduced, a relatively sharp drop in pressure ratio occurred and was followed by a continuing but more gradual reduction in pressure ratio with reduced flow. The position of the stall line on the map of pressure ratio against equivalent weight flow was essentially unaffected over the range of inlet-guide-vane and stator-blade settings. Author

N77-23114*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EMISSIONS AND TOTAL ENERGY CONSUMPTION OF A MULTICYLINDER PISTON ENGINE RUNNING ON GASOLINE AND A HYDROGEN-GASOLINE MIXTURE

John F. Cassidy Washington May 1977 38 p refs

(NASA-TN-D-8487; E-9105) Avail: NTIS HC A03/MF A01 CSCL 21A

A multicylinder reciprocating engine was used to extend the efficient lean operating range of gasoline by adding hydrogen. Both bottled hydrogen and hydrogen produced by a research methanol steam reformer were used. These results were compared with results for all gasoline. A high-compression-ratio, displacement production engine was used. Apparent flame speed was used to describe the differences in emissions and performance. Therefore, engine emissions and performance, including apparent flame speed and energy lost to the cooling system and the exhaust gas, were measured over a range of equivalence ratios for each fuel. All emission levels decreased at the leaner conditions. Adding hydrogen significantly increased flame speed over all equivalence ratios. Author

N77-23115# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

FILM COOLED SMALL TURBINE BLADE RESEARCH. VOLUME 1: AERODYNAMIC STUDY OF SECONDARY FLOWS Annual Report, period ending Jun. 1976

C. Sieverding and P. Marchal Jun. 1976 153 p refs 2 Vol. (Grant DA-ERO-75-G-074; DA Proj. 1T1-61102-B-35E)

(AD-A032262; AR-1) Avail: NTIS HC A08/MF A01 CSCL 20/4

The overall study concerns an investigation on the cooling and aerodynamic problems associated with a high speed turbine cascade of small blade height for use on small gas turbines. The secondary flow behavior in turbines is presented in Vol. I and the cooling aspects are presented in Vol. II. Vol. I reports on the study of small aspect ratio blades. A program has been initiated with the aim of obtaining a better physical understanding of the real secondary flow phenomenon. The total program will cover a period of three years. It includes very detailed low speed tests with measurements inside the blade passage, cross checking of the low speed tests in a high speed cascade and the investigation of the effect of film cooling on secondary flows. Vol. I, which reports on the first year efforts, presents mainly low speed test results and a limited amount of high speed data. GRA

N77-23116# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

FILM COOLED SMALL TURBINE BLADE RESEARCH. VOLUME 2: FILM COOLING EFFECTIVENESS AT SIMULATED TURBINE CONDITIONS Annual Report, period ending Jun. 1976

B. E. Richards, J. P. Ville, and C. Appels Jun. 1976 70 p refs 2 Vol.

(Grant DA-ERO-75-G-074; DA Proj. 1T1-61102-B-35E)

(AD-A032263; AR-1) Avail: NTIS HC A04/MF A01 CSCL 20/4

The overall study concerns an investigation on the cooling and aerodynamic problems associated with a high speed turbine cascade of small blade height for use on small gas turbines. The secondary flow behavior in turbines is presented in Vol. I and cooling aspects are presented in Vol. II. Vol. II reports on the first year efforts on the measurement of effectiveness of a film cooling system for a small turbine by injection through inclined holes. A short duration facility was used to provide isothermal wall data at flow conditions carefully selected to simulate those expected in an advanced turbine. Appropriate heat and mass transfer equations have been developed to illustrate the interpretation and usefulness of data obtained in this as yet relatively unconventional method. The measurements showed: that there are small increases in effectiveness for injection on convex surfaces compared to flat surfaces; a change in flow Reynolds number only slightly changes effectiveness; a lowering of the mainstream Mach number from 0.6 to 0.3 causes a sizable decrease in effectiveness; a pressure gradient, typical of that seen on a turbine also decreases considerably the effectiveness. GRA

N77-23117# Dayton Univ., Ohio.
ORDNANCE IMPACTS ON JET ENGINE FAN BLADES Interim Technical Report, Jan. - Jul. 1975
John P. Barber and Henry R. Taylor Apr. 1976 34 p refs
(Contract F33615-75-C-5052; AF Proj. 7351)
(AD-A031761; AFML-TR-76-34) Avail: NTIS HC A03/MF A01 CSCL 19/4

This report describes the experimental section of a program to investigate the damage that a .50 cal ogive inflicts on typical jet engine fan blade materials. Three materials, titanium, graphite epoxy composite and boron aluminum composite, were perforated by .50 caliber ogives at 488 m/s. The impact obliquities were investigated, 90 deg and 60 deg to trajectory. The momentum transfer during the impact was measured by use of a ballistic pendulum on which the targets were mounted. The momentum transfer was greatest for titanium, considerably lower for boron/aluminum and even lower for graphite expoxy. The results agree favorably with the calculated values at 90 deg but differ at 60 deg. GRA

N77-23118# Pratt and Whitney Aircraft, East Hartford, Conn.
ADVANCED CERAMIC TURBINE SEAL SYSTEM, PHASES 2 AND 3 Final Report, 1 Mar. 1974 - 15 Jun. 1976
29 Nov. 1976 89 p ref
(Contract N00140-74-C-0586)
(AD-A033196; PWA-5426) Avail: NTIS HC A05/MF A01 CSCL 21/5

'Final' design of the advanced engine graded ZrO2-NiCr turbine seal which includes thermal and structural analysis has been completed. Thermal fatigue, erosion and rub tolerance rig testing exceeded performance requirements with improved quality ceramic seals. Mechanical design of the 'final' advanced engine graded ZrO2-NiCr turbine seal has been completed. This design is compatible with an advanced engine seal design. Thermal and structural analysis of the 'final' advanced engine graded ZrO2-NiCr turbine seal predicted acceptable temperature and stress levels utilizing approximately equal to 0.75% W(ae) cooling air. Thermal fatigue, erosion and rub tests of the graded ZrO2-NiCr advanced engine turbine seal with improved quality ceramic seals have exceeded performance requirements with a thermal fatigue life greater than 500 cycles, erosion life greater than 1,600 hours for 10 mils ceramic erosion and rub tolerance which produces 10 mils of ceramic wear with less than 1 mil blade wear. X-ray inspection and superficial hardness are effective non-destructive techniques for controlling the quality of the graded ZrO2-NiCr turbine seal. Structural ceramic (SiC) turbine seal exhibited extremely poor rub tolerance and posed a very difficult compliant attachment problem to prevent high stresses (point loading) throughout the total engine cycle. Author (GRA)

N77-23119# Lockheed-Georgia Co., Marietta.
THE GENERATION AND RADIATION OF SUPERSONIC JET NOISE. VOLUME 1: SUMMARY Final Technical Report, 6 Nov. 1972 - 6 Nov. 1975
Harry E. Plumblee, Jr. Sep. 1976 140 p refs
(Contract F33615-73-C-2032; AF Proj. 3066)
(AD-A032478; LG76ER0133-Vol-1; AFAPL-TR-76-65-Vol-1)
Avail: NTIS HC A07/MF A01 CSCL 20/1

This volume contains a summary of all the work accomplished in a detailed investigation of the noise characteristics of supersonic jet aircraft, as well as a summary of items in an exploratory program. There are three main sections. The first summarizes the problems with existing theories at the time the contract was initiated. The second outlines the criteria for a unified self-consistent theory of aerodynamic noise generation, and presents, a brief derivation of Lilley's equation which is the basis for the theoretical studies in jet noise generation and radiation. The third section summarizes the work accomplished. GRA

N77-23120# Boeing Aerospace Co., Seattle, Wash.
INTEGRATED PROPULSION CONTROL SYSTEM (IPCS). VOLUME 2: TECHNICAL DESCRIPTION Final Technical Report, 1 Mar. 1973 - 30 Aug. 1976
Leon C. Billig Aug. 1976 200 p refs
(Contract F33615-73-C-2035)
(AD-A033774; AFAPL-TR-76-61-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 21/5

The Integrated Propulsion Control System (IPCS) program was conducted to pursue and demonstrate the advantages of integrated propulsion controls. The program encompassed the design, build, flight qualification, and flight testing of control modes, software, and hardware. The flight test vehicle was an F-111E. The left inlet and TF30-P-9 engine were modified to operate under control of an HDC-601 computer. Two sets of hardware were built or modified and two sets of software were developed; one implemented the bill-of-materials control laws and one implemented control laws developed under contract. A step-by-step sequence of tests of increasing complexity demonstrated suitability for flight. Fifteen flights were conducted to evaluate the IPCS. This document describes the design, fabrication, and ground testing of the IPCS. Author (GRA)

N77-23121# Boeing Aerospace Co., Seattle, Wash.
INTEGRATED PROPULSION CONTROL SYSTEM (IPCS). VOLUME 3: FLIGHT TEST REPORT Final Technical Report, 1 Mar. 1973 - 30 Aug. 1976
William J. Hastings and Christopher M. Carlin Aug. 1976 340 p refs
(Contract F33615-73-C-2035)
(AD-A034172; AFAPL-TR-76-61-Vol-3) Avail: NTIS HC A15/MF A01 CSCL 21/5

The Integrated Propulsion Control System (IPCS) program was conducted to pursue and demonstrate the advantages of integrated propulsion controls. The program encompassed the design, build, flight qualification, and flight testing of control modes, software, and hardware. The flight test vehicle was an F-111E. The left inlet and TF30-P-9 engine were modified to operate under control of an HDC-601 computer. Two sets of hardware were built or modified and two sets of software were developed; one implemented the bill-of-materials control laws and one implemented control laws developed under contract. Fifteen flights were conducted to evaluate the IPCS. The testing demonstrated that integrated digital propulsion control is effective. This document describes the flight test program and flight test results. Author (GRA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N77-23122 California Univ., Berkeley.
EFFECTS OF CROSS-COUPLING ON THE STABILITY OF AIRCRAFT Ph.D. Thesis
Bijan Davari 1976 70 p
Avail: Univ. Microfilms Order No. 77-4431

The behavior of modern supersonic aircraft of inertially slender configurations in maneuvers involving large rates of roll is presented. Inertia cross-coupling, as well as a linear variation of Cm alpha with angle of attack, are considered in the analysis. The set of five coupled and non-linear differential equations of motion, based on the principal inertia axes, is non-dimensionalized, and then simplified by order-of-magnitude considerations. There are two critical values of aileron deflection that define a range in which no steady-state is possible and, therefore, the motion is unstable. For aileron deflections near these critical values the response of the aircraft exhibits violent oscillations. This phenomenon, is due to the variation of Cm alpha with angle of attack in a cross-coupled motion. Dissert. Abstr.

N77-23123*# Boeing Commercial Airplane Co., Seattle, Wash.
FLEXSTAB: A SUMMARY OF THE FUNCTIONS AND CAPABILITIES OF THE NASA FLEXIBLE AIRPLANE ANALYSIS COMPUTER SYSTEM
E. N. Tinoco and J. E. Mercer Feb. 1975 43 p refs
(Contract NAS2-5006)
(NASA-CR-2564; D6-41098) Avail: NTIS HC A03/MF A01 CSCL 01C

NASA's aeroelastic stability and control computer program-FLEXSTAB - is described. Information is provided to aid potential users in evaluating possible use of FLEXSTAB. A summary of

the program's capabilities, the scope and limitations of its formulation, and a description of its documentation are provided. Computer program hardware and software requirements and recent user experience are also discussed. Author

N77-23124*# Boeing Commercial Airplane Co., Seattle, Wash.
A METHOD FOR PREDICTING THE STABILITY CHARACTERISTICS OF AN ELASTIC AIRPLANE. VOLUME 1: FLEXSTAB THEORETICAL DESCRIPTION
A. R. Dusto, G. W. Brune, G. M. Dornfield, J. E. Mercer, S. C. Pilet, P. E. Rubbert, R. C. Schwanz, P. Smutny, E. N. Tinoco, and J. A. Weber Oct. 1974 653 p refs Prepared in cooperation with Boeing Computer Services, Inc., Seattle, Wash.
(Contract NAS2-5006)
(NASA-CR-114712; D6-41064-1) Avail: NTIS HC A99/MF A01 CSCL 01C

The theoretical mechanics of a flexible body are integrated with a low frequency unsteady aerodynamic theory employing linear influence coefficients based on finite element approximations to resolve the dynamics of a flexible aircraft into structural dynamics of free vibration modes superimposed on rigid body dynamics. This resolution is made using a mean reference frame for structural motions and leads to a logical merger of quasi-steady and dynamic aeroelasticity through the residual flexibility approximation, and a logical basis for incorporating into the analysis empirical, rigid aircraft aerodynamic data. The aerodynamic theory is applicable to subsonic and supersonic flow and multiple wing-body-tail-nacelle configurations. Aerodynamic influence coefficients are derived using a paneling scheme which lends itself to empirical corrections. The theoretical aero- and structural dynamics are integrated, conserving energy of the system and yielding equations of motion appropriate to stability evaluation. These equations are expressed for a steady, reference motion to determine trim and static stability. They are also expressed in terms of unsteady perturbations about the reference motion to determine dynamic stability by characteristic roots or by time histories following an initial perturbation or following penetration of a discrete gust flow field. Author

N77-23125*# Boeing Commercial Airplane Co., Seattle, Wash.
A METHOD FOR PREDICTING THE STABILITY CHARACTERISTICS OF AN ELASTIC AIRPLANE. VOLUME 2: FLEXSTAB 1.02.00 USER'S MANUAL
G. R. Hink, R. N. Snow, K. G. Bhatia, R. E. Maier, G. R. Bills, D. M. Henderson, D. C. Bailey, G. M. Dornfield, and P. V. Dauria Oct. 1974 564 p refs Prepared in cooperation with Boeing Computer Services, Inc. 4 Vol.
(Contract NAS2-5006)
(NASA-CR-114713; D6-41064-2) Avail: NTIS HC A24/MF A01 CSCL 01C

Directions are given for preparing input data, executing programs, and interpreting FLEXSTAB computer program results to predict the stability and control characteristics of an elastic airplane in subsonic and supersonic flight. Author

N77-23126*# Boeing Commercial Airplane Co., Seattle, Wash.
A METHOD FOR PREDICTING THE STABILITY CHARACTERISTICS OF AN ELASTIC AIRPLANE. VOLUME 3: FLEXSTAB 1.02.00 PROGRAM DESCRIPTION
Gary R. Hink, P. V. DAuria, D. C. Bailey, G. R. Bills, and D. M. Henderson Oct. 1974 753 p refs Prepared in cooperation with Boeing Computer Services, Inc. 4 Vol.
(Contract NAS2-5006)
(NASA-CR-114714; D6-41064-3) Avail: NTIS HC A99/MF A01 CSCL 01C

The architecture of the FLEXSTAB system and the important internal blocks of logic within each program of the system are described. General information flow schematics depiciting major areas where data are input to and output from each program are also shown. Program maintenance, updating, and modification are discussed. Author

N77-23127*# Purdue Univ., Lafayette, Ind.
EFFECTS OF CONTROL LAWS AND RELAXED STATIC STABILITY ON VERTICAL RIDE QUALITY OF FLEXIBLE AIRCRAFT
Philip A. Roberts, Robert L. Swaim, David K. Schmidt, and Andrew J. Hinsdale Apr. 1977 109 p refs
(Grant NsG-4003)
(NASA-CR-143843; H-962) Avail: NTIS HC A06/MF A01 CSCL 01C

State variable techniques are utilized to generate the RMS vertical load factors for the B-52H and B-1 bombers at low level, mission critical, cruise conditions. A ride quality index is proposed to provide meaningful comparisons between different controls or conditions. Ride quality is shown to be relatively invariant under various popular control laws. Handling quality variations are shown to be major contributors to ride quality variations on both vehicles. Relaxed static stability is artificially implemented on the study vehicles to investigate its effects on ride quality. The B-52H ride quality is generally degraded when handling characteristics are automatically restored by a feedback control to the original values from relaxed stability conditions. The B-1 airplane shows little ride quality sensitivity to the same analysis due to the small rigid body contribution to load factors at the flight condition investigated. Author

N77-23128*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
BACKUP FLIGHT CONTROL SYSTEM FUNCTIONAL EVALUATOR SOFTWARE MANUAL
Charles A. Helmke, Steve H. Hasara, and Frances E. Mount Apr. 1977 144 p
(Contract NAS9-15200)
(NASA-CR-151361; LEC-10119) Avail: NTIS HC A07/MF A01 CSCL 01C

The software for the Backup Flight Control System Functional Evaluator (BFCSFE) on a Data General Corporation Nova 1200 computer consists of three programs: the ground support program, the operational flight program (OFP), and the ground pulse code modulation (PCM) program. The Nova OFP software is structurally as close as possible to the AP101 code; therefore, this document highlights and describes only those areas of the Nova OFP that are significantly different from the AP101. Since the Ground Support Program was developed to meet BFCSFE requirements and differs considerably from the AP101 code, it is described in detail. Author

N77-23129# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
RPV REMOTE CONTROL: PITCH ATTITUDE VERSUS FLIGHT PATH ANGLE
Michael D. Clader and Kenneth W. McElreath Sep. 1976 22 p
(AD-A031479; AMRL-TR-76-69) Avail: NTIS HC A02/MF A01 CSCL 05/9

A man-in-the-loop simulation study was performed to investigate remote operator control of an RPV during approach and landing in instrument conditions. Pitch attitude and flight path angle stabilization were compared using both pilots and nonpilots. The results showed better performance with flight path angle stabilization; however, loss rates were high for all modes. Recommendations were made concerning remote operator control during routine operations. Author (GRA)

N77-23130# ARO, Inc., Arnold Air Force Station, Tenn.
AIRCRAFT MOTION SENSITIVITY TO CROSS AND CROSS-COUPLING DAMPING DERIVATIVES Final Report, 1 Jul. 1975 - 30 Jun. 1976
R. W. Butler AEDC Nov. 1976 55 p refs
(ARO Proj. P33A-C5A)
(AD-A032654; ARO-PWT-TR-76-88; AEDC-TR-76-138) Avail: NTIS A04/MF A01 CSCL 01/2

An investigation was conducted to provide some insight into the importance of dynamic cross and cross-coupling derivatives in motion simulation studies of fighter aircraft in the maneuvering flight regime. The aircraft motion sensitivity to the various derivatives is ascertained in level and turning flight utilizing a 5 deg of freedom linearized stability program. The results are presented in a root locus format. GRA

N77-23131# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A CONTROL THEORETIC STUDY OF THE NUCLEAR VULNERABILITY OF THE AIR REFUELING TASK M.S. Thesis

John T. Merrifield Dec. 1976 149 p refs
(AD-A034946; GA/MC/76D-10) Avail: NTIS HC A07/MF A01 CSCL 01/2

A hypothetical air refueling operation involving a B-52H bomber and a KC-135 tanker is modeled on an analog computer for the purpose of determining its vulnerability to air turbulence and pilot gain decrement due to irradiation. The model includes: (1) Longitudinal small perturbation equations of motion for the B-52H in the downwash flow field of the KC-135; (2) Pilot models to operate the elevator and throttle of the B-52H; and (3) A stochastic gust model which provides vertical gust disturbances to the equations of motion. The controlled elements with and without downwash are derived for the refueling task. Comparison of these transfer functions shows that the downwash causes instability. Stability analyses are conducted on the pilot-aircraft open-loop transfer functions over a range of pilot rate to displacement weighting, T sub L, and pilot gains are found which will stabilize the system for each value of T sub L. Monte Carlo simulations of the refueling task are run at varying combinations of T sub L, rms gust intensity, pilot thrust authority, and pilot gain decrement due to irradiation. Trends of mean refueling time are predicted. GRA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N77-23132# Human Resources Research Organization, Alexandria, Va.
THE ROLE OF AUTOMATED TRAINING IN FUTURE ARMY FLIGHT SIMULATORS Final Report
Robert N. Isley and Edward J. Miller Oct. 1976 131 p refs
(Contract N61339-76-C-0050)
(AD-A034414; HumRRO-FR-ED-76-27) Avail: NTIS HC A07/MF A01 CSCL 05/9

The purpose of Project ATRAIN has been to develop a model of automated training in Army simulated flight training. The model is intended to provide a description for simulator designers of the role of automated training in Army simulator training and to provide guidelines for the incorporation of automated training features in future simulator design. The emphasis throughout this study has been upon development of the model and the supporting data necessary for effective training through use of the automated training features of existing and future devices, rather than upon study of various mechanisms for automating training. Data were derived through surveys of present utilization of automated training features in selected Army and non-Army flight simulators and through a review of the literature on the operational use of such features in flight training programs.
Author (GRA)

N77-23133# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
AN EXPERIMENTAL FACILITY FOR DYNAMIC COMBINED ENVIRONMENTS RELIABILITY TESTING OF AIRBORNE EQUIPMENT Final Report, Jan. 1974 - Oct. 1975
Arnold H. Mayer and David K. Prather Oct. 1976 94 p refs
(AF Proj. 6416)
(AD-A034499; AFFDL-TR-76-108) Avail: NTIS HC A05/MF A01 CSCL 14/2

A newly developed experimental facility can assess in-service reliability of airborne equipment under the dynamic combined environments encountered in flight. Virtually complete simulation of the airborne equipment environment is achieved by predominantly magnetic tape controlled scheduling of random mechanical vibrations, compartment air temperature, altitude, cooling air flow rate, temperature, and humidity at the rapid rates of variation produced in high performance aircraft. The design, engineering development, operational capability, and associated aspects of construction and operation are documented along with some early operating experience with actual avionics hardware. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N77-23134*# United Technologies Research Center, East Hartford, Conn.
PROCESSING EUTECTICS IN SPACE Final Report, Jun. 1973 - Jan. 1977
F. C. Douglas and S. F. Galasso 10 Feb. 1977 31 p refs
(Contract NAS8-29669)
(NASA-CR-150251; R77-911721-11) Avail: NTIS HC A03/MF A01 CSCL 22A

The examination of the Ni-Mo-Al system is discussed. Experiments were performed to examine the role of thermal gradient magnitude at the solidifying interface on the geometrical regularity of the microstructure. The difficulty in measuring the thermal gradient in the melt using superheat temperatures as high as 1800 C resulted in the examination of three liquid temperature gradient ranges. Examination of the microstructure from directionally solidified ingots using transverse sections indicated that the highest gradient runs produced microstructure of no greater regularity than runs made at lower gradients. For the Ni-Al-Mo monovariant eutectic system, the magnitude of the thermal gradient at the solidifying interface is not a controlling parameter with respect to the geometrical regularity of the microstructure, provided it is sufficient to satisfy the gradient/rate ratio needed to produce a planar interface growth. Author

N77-23135*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
FORMULATION OF CONSUMABLES MANAGEMENT MODELS: CONSUMABLES ANALYSIS/CREW SIMULATOR INTERFACE REQUIREMENTS
M. A. Zamora 29 Apr. 1977 17 p refs
(Contract NAS9-14264)
(NASA-CR-151334; TRW-26821-H015-RO-00) Avail: NTIS HC A02/MF A01 CSCL 22A

Consumables analysis/crew training simulator interface requirements were defined. Two aspects were investigated: consumables analysis support techniques to crew training simulator for advanced spacecraft programs, and the applicability of the above techniques to the crew training simulator for the space shuttle program in particular. Author

N77-23136*# Grumman Aerospace Corp., Bethpage, N.Y.
ORBITAL CONSTRUCTION DEMONSTRATION STUDY Final Report
1 Dec. 1976 78 p
(Contract NAS9-14916)
(NASA-CR-151352; NSS-OC-RP-008) Avail: NTIS HC A05/MF A01 CSCL 22A

A conceptual design and program plan for an Orbital Construction Demonstration Article (OCDA) was developed that can be used for evaluating and establishing practical large structural assembly operations. A flight plan for initial placement and continued utility is presented as a basic for an entirely new shuttle payload line-item having great future potential benefit for space applications. The OCDA is a three-axis stabilized platform in low-earth orbit with many structural nodals for mounting large construction and fabrication equipments. This equipment would be used to explore methods for constructing the large structures for future missions. The OCDA would be supported at regular intervals by the shuttle. Construction experiments and consumables resupply are performed during shuttle visit periods. A 250 kw solar array provides sufficient power to support the shuttle while attached to the OCDA and to run construction experiments at the same time. Wide band communications with a Telemetry and Data Relay Satellite compatible high gain antenna can be used between shuttle revisits to perform remote controlled, TV assisted construction experiments. Author

N77-23137*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PROPOSED CHANGES IN THE MISSION CONTROL JACCHIA ATMOSPHERIC MODEL
A. J. Solis Apr. 1977 7 p refs
(Contract NAS9-15200)
(NASA-CR-151357; LEC-10447; JSC-12616) Avail: NTIS HC A02/MF A01 CSCL 22A

The space shuttle orbit prediction program uses the Jacchia Atmospheric model. The errors in the shuttle orbit prediction are investigated by not considering variations in solar flux or geomagnetic activity. Author

N77-23138*# Grumman Aerospace Corp., Bethpage, N.Y.
ORBITAL CONSTRUCTION DEMONSTRATION STUDY. EXECUTIVE SUMMARY Final Report
Dec. 1976 44 p
(Contract NAS9-14916)
(NASA-CR-151359) Avail: NTIS HC A03/MF A01 CSCL 22A

The supported construction base concept (no permanent habitation quarteers) was explored. The studies concentrated on: (1) representative large structures that can only be tested in space, (2) definition of initial construction base (add-on to cover applications of facility), and (3) programmatic issues of schedule and cost, and mission plans. Author

N77-23139*# National Aeronautics and Space Administration, Washington, D. C.
DESTINATION MOON: A HISTORY OF THE LUNAR ORBITER PROGRAM
Bruce A. Byers Apr. 1977 148 p refs
(NASA-TM-X-3487) Avail: NTIS HC A18/MF A01 CSCL 22A

The origins of the Lunar Orbiter Program and the activities of the missions then in progress are documented. The period 1963 - 1970 when lunar orbiters were providing the Apollo program with photographic and selenodetic data for evaluating proposed astronaut landing sites is covered. Author

N77-23140# Battelle Inst., Frankfurt am Main (West Germany). Hauptabt. Physik.
PRODUCTION OF DISPERSION ALLOYS WITH ULTRASOUND UNDER ZERO GRAVITY CONDITIONS, PHASE 1 Final Report
Ernst-Guenter Lierke and Wolfgang Heide Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 131 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-395)
(Contracts BMFT-SLN-7751; DFVLR-BPT-01QV315-V22)
(BMFT-FB-W-76-22; BF-R-62866) Avail: NTIS HC A07/MF A01; ZLDI, Munich DM 27.55

The investigations are based on publications concerning the technological application of ultrasonic vibrations for mixing, emulsification, dispersion, and degassing of liquids, especially metal melts, at terrestrial conditions. The main effect involved, the acoustical cavitation, was extensively analyzed taking into consideration the main parameters of metal melts for microgravity applications. The mixing system is part of the general equipment for Spacelab and will be used for emulsification of metals with miscibility gap, for mixing nonmetallic particles and whiskers in metal melts, and for nucleation of gas bubbles in metal melts prior to solidification. During the definition phase of the investigations good chances for a successful application of the mixing system become obvious. First designs are proposed for small probe mixing (1st Spacelab mission) and for continuous flow mixing of larger quantities (later missions). Detailed considerations of later hardware components especially on material problems (cartridges, transducer material, coating) are included.
Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N77-23141*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRECISION ORBIT COMPUTATIONS FOR STARLETTE
James G. Marsh and Ronald G. Williamson Dec. 1976 27 p refs Submitted for publication
(NASA-TM-X-71303; X-921-77-25) Avail: NTIS HC A03/MF A01 CSCL 22A

The Starlette satellite, launched in February 1975 by the French Centre National d'Etudes Spatiales, was designed to minimize the effects of nongravitational forces and to obtain the highest possible accuracy for laser range measurements. Analyses of the first four months of global laser tracking data confirmed the stability of the orbit and the precision to which the satellite's position is established. Author

N77-23142# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MAXIMUM PAYLOAD, FOUR-IMPULSE, NON-COPLANAR, ORBITAL TRANSFERS FOR AN UPPER STAGE VEHICLE OF THE SPACE TRANSPORTATION SYSTEM M.S. Thesis
Rodney Alan Connell Dec. 1976 83 p refs
(AD-A034758; GA/MC/76D-6) Avail: NTIS HC A05/MF A01 CSCL 22/3

Payload capabilities were calculated for an expendable upper stage vehicle compatible with the Space Shuttle Vehicle. Analysis was performed for a four-stage vehicle that was modeled with impulsive thrust and transfer trajectories which obey restricted two-body equations of motion. The magnitude of the maximum payload deployed into one of two specified orbits when the other payload is known is solved by breaking the four-impulse transfer into two dual-impulse transfer trajectories. The maximum payload solution for one transfer depends upon the specified payload of the other transfer. Each of the dual-impulse transfer trajectories is determined by solving a quartic equation in the square root of the semi-latus rectum of the transfer orbit. Maximum payload capability was dependent upon the available impulse, the angle between orbit planes, the difference in the radii of the terminal orbits, the plane changes at departure and arrival points, and the transfer angle. Transfer solutions were programmed on a CDC 6600 digital computer. Computed results indicate that the model vehicle is capable of many non-coplanar orbit-to-orbit transfers that still yield practical payloads. As the transfer angle deviates from the neighborhood around 180 deg and the other geometrical parameters increase, the payload decreases. Author (GRA)

N77-23143# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN ENERGY MANAGEMENT GUIDANCE SCHEME APPLICABLE TO THE INTERIM UPPER STAGE M.S. Thesis
Jackie L. Roberts Dec. 1976 166 p refs
(AD-A034005; GA/EE/76-1) Avail: NTIS HC A08/MF A01 CSCL 22/3

A workable open loop guidance scheme for orbital transfer maneuvers is developed for a two stage solid-rocket vehicle which has no thrust termination capability. The scheme effectively manages any excess energy by matching a non-Hohmann transfer trajectory to the fixed energy capabilities of the vehicle. The entire burden of effecting the transfer is put on prelaunch targeting, so that during the burns the thrust can be directed along a precomputed direction using constant attitude maneuvers only. A computer program has been developed which employs a nonlinear equation solving routine to accomplish exact targeting for the finite-thrust transfer maneuver. The transfer trajectory is characterized by 6 control parameters (outputs of targeting, and the final orbit is defined by a set of 'hit conditions'. An error analysis is performed on the scheme throughout the range of possible trajectories which exist for excess energy missions. These trajectories are compared on the basis of optimality, such as minimum insertion errors and transfer time. Results are presented for geosynchronous and subsynchronous transfers between circular orbits. GRA

N77-23144# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MAXIMUM PAYLOAD ORBITAL TRANSFERS FOR A SPACE SHUTTLE SOLID-FUEL UPPER STAGE VEHICLE M.S. Thesis

John W. Mocko Dec. 1976 112 p refs
(AD-A034947; GA/MC/76D-11) Avail: NTIS HC A06/MF A01 CSCL 22/2

A two-stage, solid-fuel proposal for the Interim Upper Stage Vehicle of th Space Transportation System has been selected for use by the Department of Defense. It is the purpose of this study to investigate the capabilities of such a vehicle in terms of the maximum payload which can be delivered to orbit. This optimal payload problem is examined in light of three energy management techniques. The first technique, thrust termination, involves shutting off engine thrust prior to complete use of propellant. The second technique investigates the effects on payload of varying the central angle through which the transfer is made. The third technique, offloading, examines the possibility of reducing the amount of available fuel for either stage prior to the mission to determine if payloads can be increased. Finite burn periods are assumed in this study. A multipoint boundary value problem results from the appearance of interior constraints in the problem. A numerical technique is used to generate solutions for a range of transfers in the special coplanar problem. Conclusions are discussed for each of the three energy management techniques in the coplanar transfer. Even though non-optimal noncoplanar results were obtained it is belived that the general coplanar results can be extended to the noncoplanar problem. Author (GRA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N77-23145*# Georgia Inst. of Tech., Atlanta. Electric Power Lab.
PROTECTION COORDINATION OF THE KENNEDY SPACE CENTER ELECTRIC DISTRIBUTION NETWORK Summary Report
[1976] 128 p
(Contract NAS10-8375)
(NASA-CR-153052) Avail: NTIS HC A07/MF A01 CSCL 14B

A computer technique is described for visualizing the coordination and protection of any existing system of devices and settings by plotting the tripping characteristics of the involved devices on a common basis. The program determines the optimum settings of a given set of protective devices and configuration in the sense of the best expected coordinated operation of these devices. Subroutines are given for simulating time versus current characteristics of the different relays, circuit breakers, and fuses in the system; coordination index computation; protection checks; plotting; and coordination optimation. Author

N77-23146*# Georgia Inst. of Tech., Atlanta. Electric Power Lab.
NETWORK MODEL AND SHORT CIRCUIT PROGRAM FOR THE KENNEDY SPACE CENTER ELECTRIC POWER DISTRIBUTION SYSTEM Summary Report
[1976] 143 p
(Contract NAS10-8375)
(NASA-CR-153051) Avail: NTIS HC A07/MF A01 CSCL 14B

Assumptions made and techniques used in modeling the power network to the 480 volt level are discussed. Basic computational techniques used in the short circuit program are described along with a flow diagram of the program and operational procedures. Procedures for incorporating network changes are included in this user's manual. Author

N77-23147*# Georgia Inst. of Tech., Atlanta. Electric Power Lab.
VOLTAGE PROFILE PROGRAM FOR THE KENNEDY SPACE CENTER ELECTRIC POWER DISTRIBUTION SYSTEM Summary Report
[1976] 35 p
(Contract NAS10-8375)
(NASA-CR-153053) Avail: NTIS HC A03/MF A01 CSCL 14B

The Kennedy Space Center voltage profile program computes voltages at all busses greater than 1 Kv in the network under various conditions of load. The computation is based upon power flow principles and utilizes a Newton-Raphson iterative load flow algorithm. Power flow conditions throughout the network are also provided. The computer program is designed for both steady state and transient operation. In the steady state mode, automatic tap changing of primary distribution transformers is incorporated. Under transient conditions, such as motor starts etc., it is assumed that tap changing is not accomplished so that transformer secondary voltage is allowed to sag. Author

N77-23148# Consiglio Nazionale delle Ricerche, Rome (Italy). Servizio Attivita Spaziali.
UTEX: INTEGRATED ULTRAVIOLET AND X-RAY ASTRONOMY FACILITY ON SPACELAB, PHASE A STUDY. VOLUME 3: ENGINEERING STUDIES Final Report
Jul. 1976 514 p refs 4 Vol.
(Contract ESA-SC/2604-HQ)
(CNR-LAB(76)-122-Vol-3; ESA-CR(P)-896-Vol-3) Avail: NTIS HC A22/MF A01

Studies on the engineering aspects of the UTEX telescope are presented. The optical configuration was investigated and a Ritchey-Chretien telescope with a Schmidt class focal reducer was retained. The package for the X-ray detector is described. Timing facilities are discussed. Structural aspects of the telescope are dealt with. A preliminary approach was made to the thermal control subsystem. The accomodation of the main instruments behind the focal plane is discussed. A tradeoff study of detectors for use in the focal plane is presented. Additional equipment for data management is proposed. An autonomous facility for telescope pointing and stabilization is discussed. For individual titles, see N77-23149 through N77-23157.

N77-23149 Consiglio Nazionale delle Ricerche, Rome (Italy). Servizio Attivita Spaziali.
OPTICAL STUDIES
F. Scandone, P. Benvenuti (Astrophys. Obs. Asiago, Italy), and M. Detaille (Lab. d'Astronomie Spatiale) *In its* UTEX: Integrated UV and X-ray Astronomy Facility on Spacelab, Phase A Study, Vol. 3 Jul. 1976 125 p 4 Vol. (For primary document see N77-23148 14-14)
Avail: NTIS HC A22/MF A01

A study was made to select the optical facility for an integrated ultraviolet and X-ray telescope. The general philosophy is provision of a moderate cost instrument with a high degree of flexibility. Four candidate configurations were examined and from this a 60 cm f/8 Ritchey-Chretien telescope with f/2.4 Schmidt class focal reducer was retained as baseline. The technology of this facility is optimized with respect to materials and coatings. Optical tests were carried out, and a development plan together with cost aspects is given. ESA

N77-23150# Laboratorio di Astrofisica Spaziale, Frascati (Italy).
X-RAY DETECTOR
G. Auriemma, P. Ubertini, G. Boella, and G. Medici *In* CNR UTEX: Integrated UV and X-ray Astronomy Facility on Spacelab, Phase A Study, Vol. 3 Jul. 1976 43 p 4 Vol. (For primary document see N77-23148 14-14)
Avail: NTIS HC A22/MF A01

The package for the X-ray detector used in the Spacelab-borne UV astronomy telescope is described. The requirements for the detector are wide range of wavelengths, high flexibility, modularity, low weight, and high background discrimination, in order to obtain the following scientific output: high timing resolution and moderate spectral resolution over a wide energy range. The type of detector selected is a proportional counter, since this offers the best overall energy resolution and sensitivity. ESA

N77-23151# Istituto Elettrotecnico Nazionale (Galileo Ferraris), Turin (Italy).
TIME BASE SUBSYSTEM

G. Rovera *In* CNR UTEX: Integrated UV and X-ray Astronomy Facility on Spacelab, Phase A Study, Vol. 3 Jul. 1976 36 p refs 4 Vol. (For primary document see N77-23148 14-14)
Avail: NTIS HC A22/MF A01

Timing facilities onboard Spacelab and their suitability for the UTEX experiments are discussed. The timing requirements for the UTEX experiments are reviewed and the proposed solution is characterized in detail by its technical performance. Development and cost problems are reviewed. ESA

N77-23152# Aeritalia, Turin (Italy).
CONFIGURATION AND STRUCTURE SUBSYSTEM. FEASIBILITY STUDY
G. Finocchiaro, G. Fubini, F. Lombardi, and A. DeLuca *In* CNR UTEX: Integrated UV and X-ray Astronomy Facility on Spacelab, Phase A Study, Vol. 3 Jul. 1976 46 p 4 Vol. (For primary document see N77-23148 14-14)
(AIT-TASS-76-G-1741) Avail: NTIS HC A22/MF A01

A preliminary analysis of the UTEX telescope configuration and structural subsystem is presented. The structure must provide the support and proper alignment of the optics, mechanisms, instrumentation, and detectors. It consists of the focal reducer bay, the instrumentation bay, the telescope structure, and the 45 deg sun shade (rotating). A simplified mathematical model of 166 nodes was analyzed by means of a NASTRAN program. The results are considered satisfactory. ESA

N77-23153# Aeritalia, Turin (Italy).
THERMAL CONTROL SUBSYSTEM. FEASIBILITY STUDY
G. Pellis, L. Bussolino, A. Ferrarese, and S. DellAmico *In* CNR UTEX: Integrated UV and X-ray Astronomy Facility on Spacelab, Phase A Study, Vol. 3 Jul. 1976 45 p 4 Vol. (For primary document see N77-23148 14-14)
(AIT-TASS-76-B-1740) Avail: NTIS HC A22/MF A01

Information is provided to define Orbiter/Spacelab operational conditions, thermal pallet interfaces, and a preliminary approach to UTEX thermal control design. A general temperature distribution is described by means of a representative mathematical model with a nodal breakdown of 142 nodes, integrated in the orbiter/pallet model. It is concluded that the order of magnitude for required gradients and temperature control appears achievable by means of current passive control techniques. Some equipment and components present special requirements for temperature control, achievable by active techniques. ESA

N77-23154# Osservatorio Astrofisico, Asiago (Italy).
FOCAL PLANE INSTRUMENTATION. ACCOMMODATION STUDY
R. Stagni and G. Tondello (Arcetri Astrophys. Obs., Italy) *In* CNR UTEX: Integrated UV and X-ray Astronomy Facility on Spacelab, Phase A Study, Vol. 3 Jul. 1976 51 p refs 4 Vol. (For primary document see N77-23148 14-14)
Avail: NTIS HC A22/MF A01

The accommodation of the main instruments behind the focal plane of the UTEX telescope is discussed. These are: the field acquisition system, spectrometers, the objective grating, the photon counting photometer, and a photographic camera. Preliminary specifications of the various units were also considered to the extent they were necessary to the accomodation study. The field acquisition system is limited to a possible optical concept to be reviewed during further phases. ESA

N77-23155# Osservatorio Astronomico, Padova (Italy).
DETECTORS FOR FOCAL PLANE INSTRUMENTATION. TRADE-OFF STUDY
S. DiSerego *In* CNR UTEX: Integrated UV and X-ray Astronomy Facility on Spacelab, Phase A Study, Vol. 3 Jul. 1976 64 p refs 4 Vol. (For primary document see N77-23148 14-14)
Avail: NTIS HC A22/MF A01

A trade-off study of detectors for use in the focal plane of the UTEX telescope is presented. Scientific requirements, facility specifications, and accommodation constraints of instruments in the instrument bay are considered. The following functions are identified: rapid photometry at f/8, imaging at f/8, imaging with focal reducer at f/2.4, spectroscopy at f/8 of point sources and extended objects, and field acquisition for pointing and guiding at f/8. Conclusions relating to the basic configurations are detailed. ESA

N77-23156# Istituto Elettrotecnico Nazionale (Galileo Ferraris), Turin (Italy).
DATA MANAGEMENT SUBSYSTEM
F. Giorda *In* CNR UTEX: Integrated UV and X-ray Astronomy Facility on Spacelab, Phase A Study, Vol. 3 Jul. 1976 51 p 4 Vol. (For primary document see N77-23148 14-14)
Avail: NTIS HC A22/MF A01

The existing facilities for data management of the UTEX telescope instrumentation are outlined, and the requirements of the system and each experiment are summarized. A comparison is made between these requirements and existing facilities leading to a request for implementation of additional equipment. ESA

N77-23157# Aeritalia, Turin (Italy).
AUTONOMOUS POINTING AND STABILIZATION SUBSYSTEM. FEASIBILITY STUDY
G. Farnetani and E. Turci *In* CNR UTEX: Integrated UV and X-ray Astronomy Facility on Spacelab, Phase A Study, Vol. 3 Jul. 1976 51 p 4 Vol. (For primary document see N77-23148 14-14)
(AIT-TASS-76-G-1739) Avail: NTIS HC A22/MF A01

An autonomous facility for the UTEX telescope pointing and stabilization is discussed in relation to the instrument pointing system provided by ESA. With a view to cost effectiveness the following principles were followed in its design: manned operation when possible to avoid unnecessary system complexity, differentiation of the pointing and stabilization functions to allow simpler logic design, two-axis stabilization, fine stabilization by using secondary mirror, and utilization of standard equipment. ESA

N77-23158# Consiglio Nazionale delle Ricerche, Rome (Italy). Servizio Attivita Spaziali.
UTEX: INTEGRATED ULTRAVIOLET AND X-RAY ASTRONOMY FACILITY ON SPACELAB, PHASE A STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
Jul. 1976 84 p 4 Vol.
(Contract ESA-SC/2604-HQ)
(CNR-LAB(76)-122-Vol-1; ESA-CR(P)-896-Vol-1) Avail: NTIS HC A05/MF A01

A multipurpose UV telescope coupled with an X-ray detector to be flown on Spacelab is described. The instrument is capable of operating in the following basic modes: imagery over a field of 1 deg 65 with a focal ratio of f/2, time resolved rapid photometry correlated with X-ray observations, spectroscopy of both point-like and extended sources, and objective grating spectroscopy. The optical layout is a 60 cm f/8 Ritchey-Chretien configuration with f/2.4 Schmidt class focal reducer. The X-ray detector is a four layer multiwire proportional counter. The engineering effort was oriented to identify possible system configurations satisfying both scientific requirements and Spacelab interfaces and constraints. ESA

N77-23159# Consiglio Nazionale delle Ricerche, Rome (Italy). Servizio Attivita Spaziali.
UTEX: INTEGRATED ULTRAVIOLET AND X-RAY ASTRONOMY FACILITY ON SPACELAB, PHASE A STUDY. VOLUME 2: FACILITY DEFINITION Final Report
Jul. 1976 159 p 4 Vol.
(Contract ESA-SC/2604-HQ)
(CNR-LAB(76)-122-Vol-2; ESA-CR(P)-896-Vol-2) Avail: NTIS HC A08/MF A01

The definition and feasibility study of an integrated ultraviolet and astronomy facility onboard Spacelab are presented. This is based on the scientific aims of different European countries. The accommodation of such a facility in the first and second Spacelab flights was also studied, taking into account external constraints of both flights and the possibility of future missions. Well identified possible work packages are outlined in view of future international cooperation. ESA

N77-23160# Consiglio Nazionale delle Ricerche, Rome (Italy). Servizio Attivita Spaziali.
UTEX: INTEGRATED ULTRAVIOLET AND X-RAY ASTRONOMY FACILITY ON SPACELAB, PHASE A STUDY. VOLUME 4: DEVELOPMENT Final Report
Jul. 1976 29 p 4 Vol.
(Contract ESA-SC/2604-HQ)
(CNR-LAB(76)-122-Vol-4; ESA-CR(P)-896-Vol-4) Avail: NTIS

HC A03/MF A01

A development and cost plan is proposed for the UTEX (Ultraviolet Telescope Experiment X-ray) telescope. Under certain assumptions, the UTEX facility can be developed in about 4 years. An overall development cost is given. ESA

N77-23161# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AIR LAUNCHED CRUISE MISSILE STAGING BASE SELECTION FOR FULL SCALE DEVELOPMENT TEST AND EVALUATION M.S. Thesis

Albert E. Hughes Sep. 1976 126 p refs

(AD-A032199; GSM/SM/76S-12) Avail: NTIS HC A07/MF A01 CSCL 05/1

A management decision is examined using the decision analysis method of Kepner and Tregoe. Four mandatory objectives and five desired objectives are established. Twenty-five air base alternatives are examined. Boeing, Wichita (Air Force Plant 57) and Kelly Air Force Base satisfy all mandatory objectives. Edwards Air Force Base does not but is continued in analysis, an option allowed by the method. The three named alternatives are ranked based on the relative degree to which they satisfy each desired objective. Wichita ranks first, Kelly second, and Edwards last. A decision risk analysis follows. The likelihood of failing to achieve objectives and the consequences of that failure are examined for each of the three alternatives. Both Kelly Air Force Base and Boeing, Wichita are acceptable. Boeing, Wichita, the highest ranked, lowest risk alternative, is recommended. GRA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N77-23162# Communications Research Centre, Ottawa (Ontario). Space Technology Branch.

ENDURANCE TESTS ON TORR TF2 RELAYS USED IN THE COMMUNICATIONS TECHNOLOGY SATELLITE

R. F. Haythornthwaite Feb. 1977 65 p refs

(CRC-1304) Avail: NTIS HC A04/MF A01

Two Torr TF2 relays were operated in vacuum at approximately 25 C with 28V coil voltage and 8A contact current for 10 days. Measurements were made at -15, 25 and 65 C. Deterioration in thermal conductivity between the coil windings and relay case was observed in some instances when the temperature was reduced between tests, resulting in increases of 50 to 80 C over the original operating temperatures. Pull-in and drop-out voltages increased, but the pull-in and drop-out currents and contact resistances were essentially unchanged. More than 230 low duty cycle operations did not further degrade the relays. No changes in make or break characteristics were observed. One relay failed to operate at -15 C during one test. Author

N77-23163*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

HEAO-A NOMINAL SCANNING OBSERVATION SCHEDULE

G. J. Fishman and R. L. Stone Apr. 1977 52 p

(NASA-TM-X-73391) Avail: NTIS HC A04/MF A01 CSCL 22A

The HEAO-A observatory, scheduled for launch in late June 1977, will spend most of its orbital lifetime in a scanning mode, spining from 0.03 to 0.1 rpm about an axis aligned with the sun. The dates of availability in the scan band are given for a list of 248 X-ray sources. Celestial maps of source locations and scan planes, and examples of the nighttime elevation of available sources are presented. This document is intended to aid ground-based observers in planning coordinated observations with HEAO-A. Author

N77-23164*# Barnes Engineering Co., Stamford, Conn.

ATTITUDE TRANSFER ASSEMBLY DESIGN FOR MAGSAT Final Report, Jun. - Sep. 1976

P. W. Collyer and N. P. Freund Oct. 1976 255 p refs

(Contract NAS5-23598)

(NASA-CR-152499) Avail: NTIS HC A12/MF A01 CSCL 22B

A description is given of a design for an instrument system that will monitor the orientation of a boom-mounted vector magnetometer relative to the main spacecraft body. The attitude of the magnetometer is measured with respect to X and Z axes lateral to the boom length and also a twist axis around the boom center line. These measurements are made in a noncontact optical approach enploying a three-axis autocollimator system mounted on the main body of the spacecraft with only passive elements (reflectors) located at the end of the 20-foot boom. Author

N77-23165*# Operations Research, Inc., Silver Spring, Md.

TDRSS/USER SATELLITE TIMING STUDY Final Report

D. McGregor, F. Douglas, and R. Kaul Nov. 1976 135 p refs

(Contract NAS5-24034)

(NASA-CR-152498) Avail: NTIS HC A07/MF A01 CSCL 22B

A timing analysis for data readout through the Tracking and Data Relay Satellite System (TDRSS) was presented. Various time tagging approaches were considered and the resulting accuracies delineated. The TDRSS was also defined and described in detail. B.B.

N77-23166# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Unternehmensbereich Raumfahrt.

COMPARATIVE SYSTEMS STUDY OF MAGNETICALLY SUSPENDED FLYWHEELS Final Report

Wolfgang Kleinau, Heinrich Weingarten, and Wolfgang Craemer Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 139 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-393)

(Contract BMFT-WRT-2074)

(BMFT-FB-W-76-20; MBB-URV-84) Avail: NTIS HC A07/MF A01; ZLDI, Munich DM 29,20

A comparative study is presented of flywheels with passive or active magnetic suspension for geostationary satellites with flexible appendages. The characteristic parameters of three available types were critically compared, and the possibility of their application in spacecraft studied. The application of magnetically suspended (fixed) flywheels was investigated for geostationary satellites with large flexible solar arrays of the OTS and TVBS type, by means of simulation. ESA

N77-23167# Aerospace Corp., El Segundo, Calif. Ivan A. Getting Labs.

EFFECTS OF ATMOSPHERIC WINDS AND AERODYNAMIC LIFT ON THE INCLINATION OF THE ORBIT OF THE S3-1 SATELLITE Interim Report

Barbara K. Ching, David R. Hickman, and Joe M. Straus 27 Oct. 1976 44 p refs

(Contract F04701-76-C-0077)

(AD-A032685; TR-0077(2960-04)-1; SAMSO-TR-76-216)

Avail: NTIS HC A03/MF A01 CSCL 22/3

Aerodynamic drag and lift effects on the inclination of the orbit of the S3-1 satellite have been used to infer atmospheric zonal wind speeds at an altitude of 175 km and to estimate the satellite surface thermal accommodation coefficient. The unusually high quality of the orbital and attitude data permitted the 7-month data span to be analyzed in 6 non-overlapping subintervals, thereby resulting in finer local-time and spatial resolution than is normally obtained in such studies. The aerodynamic lift force was found to be quite sensitive to the assumed value of the thermal accommodation coefficient, a quantity that is neither well known nor understood. The inclination data were best fit (in a least squares sense) when the accommodation coefficient was greater than 0.95. Best agreement with theoretical models in terms of wind speed and direction was obtained when the accommodation coefficient was taken to be nearly 1.0. In this case, the inferred wind was 400 m/sec eastward at local times 19-21 hr, and 200 m/sec westward at local times 7-9 hr. The study indicates that if accurate zonal wind velocities are to be derived from satellite orbital inclination changes, care must be taken to ensure that the shape and orientation of the satellite are such that the lift forces generated are sufficiently small that the resulting uncertainty due to

inadequate knowledge of the accommodation coefficient does not cause significant error. Author (GRA)

N77-23168# Defense Mapping Agency Topographic Center, Washington, D.C.
DOPPLR: A POINT POSITIONING PROGRAM USING INTEGRATED DOPPLER SATELLITE OBSERVATIONS Final Report, 1971 - 1976
Randall W. Smith, Charles Schwarz, and William D. Googe Apr. 1976 59 p
(AD-A033620; DMATC-TR-76-1) Avail: NTIS HC A04/MF A01 CSCL 22/2

This report describes the FORTRAN 5 program, DOPPLR, developed for use on the UNIVAC 1108 electronic computer. It is designed to derive the position of a reciever observing integrated Doppler shifts in transmissions from an artificial Earth satellite. Author (GRA)

N77-23169# Tri-Con Associates, Inc., Cambridge, Mass.
DESIGN AND FABRICATION OF SATELLITE ELECTRON BEAM SYSTEM
William B. Huber 1 Aug. 1976 36 p
(Contract F19628-75-C-0114)
(AD-A033191; C-140; AFGL-TR-76-0184; Scientific-1) Avail: NTIS HC A03/MF A01 CSCL 22/2

A satellite electron beam system was designed and fabricated using the Machlett Laboratories, Inc., Model EE-65 Electron Gun. The design accommodates six levels of beam current, six levels of beam energy, three focus anode levels as a percentage of beam energy, and operation in a pulsed mode synchronous with the space vehicle PCM system. All instrument operating modes are ground commandable with no automatic sequential modes of operation. Author (GRA)

N77-23170# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ATTITUDE STABILITY OF AN ORBITING SATELLITE CONTAINING FLEXIBLE ANTENNAS AND SPINNING ROTORS M.S. Thesis
Phillip Eugene Sanders Dec. 1976 51 p refs
(AD-A034761; GA/MC/76D-13) Avail: NTIS HC A04/MF A01 CSCL 22/3

This study considers the attitude stability of a gyrostat satellite containing flexible antennas, in which any, or all, of the rotors or antennas may be misaligned with the main body principal axes. The problem is formulated in general for any number of rigid, symmetrical, spinning rotors which are fixed relative to the body and for any number of antennas, modeled as rigid rods connected by torsional springs. The stability analysis is based on the Liapunov direct method, using the Hamiltonian as the Liapunov function. Examples are presented for a gravity-stabilized satellite containing one constant-speed rotor and two antennas of two rods each. The antenna misalignment and motion is restricted to the xz-plane. Results show that for a rotor misalignment, the largest deviation from the position defined by the body principal axes aligning with the orbital axes occurs when the misalignment is toward the orbit tangent. Misalignment of the antennas has no effect on the body equilibrium position except when the rotor was also misaligned. In that case, the body equilibrium angles were reduced. Author (GRA)

N77-23171# Honeywell Corporate Research Center, Bloomington, Minn.
ADVANCED DEVELOPMENT ON GALLIUM PHOSPHIDE MATERIALS FOR SATELLITE ATTITUDE SENSORS Interim Technical Report, 15 May 1975 - 29 Feb. 1976
P. E. Petersen, R. G. Schulze, and M. W. Scott Wright-Patterson AFB, Ohio AFML May 1976 101 p refs
(Contract F33615-75-C-5244; AF Proj. 7371)
(AD-A033640; HR-46492; AFML-TR-76-79) Avail: NTIS HC A06/MF A01 CSCL 20/12

The objective of this research program is to develop the solution-growth technology of GaP so that crystals of sufficient size and uniformity can be produced for Air Force photodetector applications. To accomplish this objective two growth techniques, bulk solution growth (BSG) and liquid phase epitaxy (LPE) have been developed. Undoped and copper doped LPE layers were grown. These layers were characterized by standard C-V and photoconductivity analysis. In the bulk solution growth technique GaP is dissolved at the top of a crucible of Ga, the phosphorus transports by diffusion to the bottom of the crucible which is cooler, and a GaP crystal grows from the saturated solution. A BSG growth apparatus was developed with which large area crystals of GaP have been grown. Hall analysis of these crystals shows that the majority carrier concentration is uniform to within + or - 10%. The temperature dependence of the mobility of both nand p-type BSG grown samples has been measured. IR spectroscopy and oscillatory photoconductivity and Hall analysis has been used to identify the principal impurities in both n- and p-type BSG GaP. Photocapacitance techniques have been used to study deep levels in both BSG and LPE GaP. GRA

N77-23172# Nielsen Engineering and Research, Inc., Mountain View, Calif.
CALCULATION OF COMPONENT FORCES AND MOMENTS OF ARBITRARILY BANKED CRUCIFORM MISSILES WITH CONTROL DEFLECTIONS Annual Technical Report, 1 Oct. 1975 - 30 Sep. 1976
Michael J. Hemsch, Charles A. Smith, Jack N. Nielsen, and Stanley C. Perkins, Jr. 1 Nov. 1976 229 p refs
(Contract N00014-74-C-0050; NR Proj. 215-226)
(AD-A034722; NEAR-TR-125; ONR-CR215-226-3) Avail: NTIS HC A11/MF A01 CSCL 16/4

This report describes the development of a preliminary version of a single comprehensive code for the engineering calculation of all missile component aerodynamic forces and moments, except minimum drag, for angles of attack up to the unsteady regime. The engineering method to be described in this report is composed of five basic procedures: (1) computation of forces and moments, with no external vortices present, for individual fins in the presence of a body at arbitrary angle of attack and bank angle with control deflections; (2) computation of forces and moments induced on individual fins due to the presence of external vortices; (3) calculation, using an empirical method, of the strengths and positions of body vortices generated upstream of the first set of fins; (4) computation, using a vortex tracking method, of the strengths and positions of vortices between the first and second sets of fins; and (5) determination of body forces and moments due to the presence of the fins and vortices. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N77-23173*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
EFFECTS OF SURFACE COOLING AND OF ROUGHNESS ON THE HEATING (INCLUDING TRANSITION) TO THE WINDWARD PLANE-OF-SYMMETRY OF THE SHUTTLE ORBITER
J. J. Bertin, Ed S. Idar, III, and Stanley R. Galanski Apr. 1977 79 p refs
(Contract NAS9-13680)
(NASA-CR-151337; AER-77-002) Avail: NTIS HC A05/MF A01 CSCL 20D

The theoretical heat-transfer distributions are compared with experimental heat-transfer distributions obtained in Tunnel B at AEDC using a 0.0175 scale model of the space shuttle orbiter configuration for which the first 80% of the windward surface was roughened by a simulated tile misalignment. The theoretical solutions indicate that thinning the boundary layer by surface cooling increased the nondimensionalized value of the local heat-transfer coefficient. Tile misalignment did not significantly affect the heat-transfer rate in regions where the boundary layer was either laminar or turbulent. Author

N77-23174*# National Aeronautics and Space Administration, Washington, D. C.
SPACELAB PROGRAMME OVERVIEW
D. R. Lord and B. Deloffre 1976 50 p Presented at the 13th Space Congr., Cocoa Beach, Calif., 7 Apr. 1976 Prepared

jointly with ESA
(NASA-TM-X-74165) Avail: NTIS HC A03/MF A01 CSCL 22A

The current activity status of Spacelab, objectives of which are to provide a laboratory and observation facility in space, is surveyed. Program requirements are given, and the basic Spacelab concept is described. The programmatic aspects of the program and some considerations concerning payload integration and payload operations are outlined. ESA

N77-23175# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
AMPS - SUBSATELLITE ASSESSMENT STUDY, VOLUME 1
Apr. 1976 134 p refs
(Contract ESTEC-2615/76-NI-PP(SC))
(MBB-URV-91-76-Vol-1; ESA-CR(P)-911-Vol-1) Avail: NTIS HC A07/MF A01

Results of a technical assessment study for atmospheric, magnetospheric, and plasma physics in space exploration (AMPS) by subsatellites to the Space Shuttle/Laboratory missions are presented. The model payloads, mission/orbit, spacecraft system, and subsystem aspects are dealt with. Interfaces to the Shuttle/Laboratory and the deployment/launching systems for Shuttle pallet launcher are considered. The most sophisticated version of the detached subsatellites, the attitude and orbit controlled spacecraft, OCSAT, was studied. Simple detached or tethered subsatellites were not considered. Three subsatellite candidates which appear feasible for a typical payload are described: silver/zinc battery power supply version, hybrid power supply version (battery system supported by solar cell generator), and fuel cell power supply version. ESA

N77-23176# Defense Systems Management School, Fort Belvoir, Va.
SPACE SHUTTLE: A CASE STUDY IN ECONOMIC ANALYSIS
Byron Theurer Apr. 1976 44 p refs
(AD-A033871) Avail: NTIS HC A03/MF A01 CSCL 22/2

This case study reports on an application of economic analysis; provides examples of the methods; and draws conclusions and comments on lessons learned. It was developed from NASA and contractor primary references and from the author's experiences. In 1971, NASA was faced with a dilemma. The Space Shuttle Program, which had been established to substantially reduce the cost of space operations, was being designed to reduce principally transportation cost. Issues were surfacing which established that this transportation cost emphasis did not account for Shuttle development cost and the great bulk of the costs of a satellite program. OMB, furthermore, was imposing a peak funding ceiling which precluded developing the then baselined configuration. Economic analysis performed by MATHEMATICA, Inc., succeeded in establishing the economic worth of Shuttle and pinpointing the most economical configuration. Of particular interest are the explicit treatment of uncertainty in the data base and the innovative methods used to graphically portray results. GRA

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N77-23177# Analytical and Computational Mathematics, Zurich (Switzerland).
CALIBRATION OF IONOSPHERIC EFFECTS ON VHF TRACKING
P. Kohler and S. Larcher Nov. 1976 106 p refs Sponsored by ESA Prepared for SEMA
(ESA-CR(P)-902) Avail: NTIS HC A06/MF A01

A study is presented of the effects of ionospheric perturbations on VHF tracking, based on a mathematical prediction model or on on-line calibration using auxiliary measurements. It is shown how the stochastic model of a received signal is derived with the accuracy needed for an application to tracking. Methods for predicting ionospheric perturbations on a tracking signal from a mathematical model were studied. The simultaneous use of redundant measurement made at different frequencies to compensate for ionospheric errors, based on the fact that the medium is dispersive, was considered. Results were used to complete an existing package of orbit determination software. ESA

N77-23178# Societe d'Economie et de Mathematique Appliquees, Montrouge (France).
PREEST AND EDITIONS PROGRAMS. USER MANUAL [PROGRAMMES PREEST ET EDITIONS. MANUEL D'UTILISATION]
Sep. 1976 98 p refs In FRENCH
(Contract ESOC-721/75-T)
(ESA-CR(P)-919) Avail: NTIS HC A05/MF A01

The PREEST and EDITIONS programs dealt with the preestimation of the position of a spacecraft and ionospheric models for evaluation of VHF tracking methods. ESA

N77-23179# British Aircraft Corp. (Operating) Ltd., Bristol (England). Electronics and Space Systems Group.
STUDY OF STRAPDOWN INERTIAL OPTICAL ATTITUDE MEASUREMENT SYSTEMS, VOLUME 1 Final Report
D. Todman, D. Eardley, J. Hutcheson, and L. Callard Jan. 1977 381 p 3 Vol.
(Contract ESTEC-2453/75-AK)
(ESS/SS-738-Vol-1; ESA-CR(P)-920-Vol-1) Avail: NTIS HC A17/MF A01

A study is reported on attitude measurement systems using outputs of optical and inertial sensors combined to provide a high quality attitude reference of spacecraft or inertial platforms, undergoing both small attitude precision motion (pointing mode), and large angle slewing motion. The systems considered use a star tracker capable of tracking two stars, and inertial quality rate integrating gyros. Processing is carried out digitally using a processor based on the Adaptive Control Electronics (ACE) computer. Two types of sensor mathematical models are discussed. Methods are evaluated of determining the satellite's attitude during a large angle slew maneuver. ESA

N77-23180# British Aircraft Corp. (Operating) Ltd., Bristol (England). Electronics and Space Systems Group.
STUDY OF STRAPDOWN INERTIAL OPTICAL ATTITUDE MEASUREMENT SYSTEMS, VOLUME 2 Final Report
D. Todman, D. Eardley, J. Hutcheson, and L. Callard Jan. 1977 268 p refs 3 Vol.
(Contract ESTEC-2453/75-AK)
(ESS/SS-738-Vol-2; ESA-CR(P)-920-Vol-2) Avail: NTIS HC A12/MF A01

A study is reported on attitude measurement systems using outputs of optical and inertial sensors combined to provide a high quality attitude reference of spacecraft or inertial platforms, undergoing both small attitude precision motion (pointing mode), and a large angle sleeving motion. The systems considered use a star tracker capable of tracking two stars, and inertial quality rate integrating gyros. Processing is carried out digitally using a processor based on the Adaptive Control Electronics (ACE) computer. The determination of the attitude, expressed in times of modified Euler angles, using filtering techniques is described. These factors are derived using Wiener theory, and they optimally mix the star tracker and gyro outputs. Application of the preferred form of attitude measurement is considered for a specific satellite mission. ESA

N77-23181# British Aircraft Corp. (Operating) Ltd., Bristol (England). Electronics and Space Systems Group.
STUDY OF STRAPDOWN INERTIAL OPTICAL ATTITUDE MEASUREMENT SYSTEMS, VOLUME 3
D. Todman Feb. 1977 116 p 3 Vol.
(Contract ESTEC-2453/75-AK)
(ESS/SS-772-Vol-3; ESA-CR(P)-920-Vol-3) Avail: NTIS HC A06/MF A01

A study is reported on attitude measurement systems using outputs of optical and inertial sensors combined to provide a high quality attitude reference of spacecraft or inertial platforms, undergoing both small attitude precision motion (pointing mode), and a large angle slewing motion. The systems considered use a star tracker capable of tracking two stars, and inertial quality rate integrating gyros. Processing is carried out digitally by a microprocessor. Major results and problem areas are summarized. ESA

N77-23182# IBM Federal Systems Div., Owego, N.Y.
DME SURFACE TO SURFACE MISSILE DEMONSTRATION SYSTEM ANALYSIS Final Report, 13 May - 31 Oct. 1976
31 Oct. 1976 117 p refs
(Contract DAAH01-76-A-0024)
(AD-A032155; IBM-76-L61-017) Avail: NTIS HC A06/MF A01 CSCL 16/4

System design, analysis and tests were performed in preparation for a joint U.S. Army/Air Force demonstration flight test. This flight test will involve use of the Air Force Advanced Location and Strikes System (ALSS) Distance Measuring Equipment (DME) navigation and guidance techniques for control of a Hawk missile on a surface-to-surface trajectory. Requirements are defined for the interface between the DME Weapon Guidance Subsystem and the Hawk flight control system. A DME data link antenna system was designed. Scale model antenna pattern test results are presented which validate the performance for the DME, Telemetry and Command Destruct antennas needed for flight tests. A projected flight test geometry is defined relating the missile trajectory and ALSS ground station locations. Functional requirements are identified for modifications necessary to the ALSS software to provide missile control during the flight tests. Author (GRA)

N77-23183# International Business Machines Corp., Huntsville, Ala.
DME-BASIC HAWK MISSILE SYSTEM ANALYSIS Final Report, 1 Jul. - 31 Oct. 1976
T. R. Coon and G. J. Landry 31 Oct. 1976 190 p refs
(Contract DAAH01-76-A-0024)
(AD-A031616; IBM-F18-76-H02; RG-CR-77-1) Avail: NTIS HC A09/MF A01 CSCL 16/4

The Basic HAWK missile, an obsolete surface-to-air missile in the U.S. Army inventory, is utilized to demonstrate the feasibility of Distance Measuring Equipment (DME) for guided missiles. This report presents the design of the guidance and navigation systems for a surface-to-surface application of the Basic HAWK missile using DME. Models of the Basic HAWK missile, the guidance law and the navigation filter are developed for stability analyses. The system performance characteristics obtained via simulation are also presented. Author (GRA)

N77-23184# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
ANALYSIS OF A SINGLE-BIT DIGITAL RECEIVER FOR CARRIER AND CODE TRACKING
Larry L. Horowitz Jul. 1976 138 p refs
(Contract N00017-72-C-4401)
(AD-A034213; APL/JHU-TG-1283) Avail: NTIS HC A07/MF A01 CSCL 09/4

Post-flight processing of spread-spectrum signals often requires high-rate data recording. One way to lessen the recording rate requirement is to use single-bit quantization of the sampled signal in the recording. The performance of an aided digital post-flight receiver for carrier and code tracking when single-bit quantization is utilized in the data recording is here analyzed. The assumed signal structure is used in the SATRACK-GPS program. Author (GRA)

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N77-23185*# Howard Univ., Washington, D.C. Dept. of Mechanical Engineering.
THE DYNAMICS AND OPTIMAL CONTROL OF SPINNING SPACECRAFT AND MOVABLE TELESCOPING APPENDAGES, PART A Final Report
Peter M. Bainum and R. Sellappan May 1977 77 p refs
(Grant NsG-1181)
(NASA-CR-152692) Avail: NTIS HC A05/MF A01 CSCL 22B

The problem of optimal control with a minimum time criterion as applied to a single boom system for achieving two axis control is discussed. The special case where the initial conditions are such that the system can be driven to the equilibrium state with only a single switching maneuver in the bang-bang optimal sequence is analyzed. The system responses are presented. Application of the linear regulator problem for the optimal control of the telescoping system is extended to consider the effects of measurement and plant noises. The noise uncertainties are included with an application of the estimator - Kalman filter problem. Different schemes for measuring the components of the angular velocity are considered. Analytical results are obtained for special cases, and numerical results are presented for the general case. Author

N77-23186*# Howard Univ., Washington, D.C. Dept. of Mechanical Engineering.
THE DYNAMICS AND OPTIMAL CONTROL OF SPINNING SPACECRAFT AND MOVABLE TELESCOPING APPENDAGES, PART B: EFFECT OF GRAVITY-GRADIENT TORQUES ON THE DYNAMICS OF A SPINNING SPACECRAFT WITH TELESCOPING APPENDAGES Final Report
Peter M. Bainum and Mahesh Rajan May 1977 104 p refs
(Grant NsG-1181)
(NASA-CR-152691) Avail: NTIS HC A06/MF A01 CSCL 22B

The effects of gravity gradient torques during boom deployment maneuvers of a spinning spacecraft are examined. Configurations where the booms extended only along the hub principal axes and where one or two booms are offset from the principal axes were considered. For the special case of symmetric deployment (principal axes booms) the stability boundaries are determined, and a stability chart is used to study the system behavior. Possible cases of instability during this type of maneuver are identified. In the second configuration an expression for gravity torque about the hub center of mass was developed. The nonlinear equations of motion are solved numerically, and the substantial influence of the gravity torque during asymmetric deployment maneuvers is indicated. Author

N77-23187*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PROGRAM DOCUMENTATION FOR ELAPSED TIME TO OXYGEN AND HYDROGEN CAUTION AND WARNING SYSTEM FOR CAPTIVE/ACTIVE 1 AND 3 FLIGHTS
James E. Hurst Apr. 1977 8 p ref
(Contract NAS9-15200)
(NASA-CR-151339; LEC-10443; JSC-12618) Avail: NTIS HC A02/MF A01 CSCL 22A

High pressure gas storage simulation runs were made to compute the elapsed time from T-0 disconnect (transfer to onboard reactant) to the caution and warning pressures for the primary oxygen (O2) and hydrogen (H2) systems of Orbiter Vehicle (OV) 101. The simulation runs were made for approach and landing test flights Captive/Active 1 and Captive/Active 3. Author

N77-23188# British Aircraft Corp. (Operating) Ltd., Bristol (England). Electronics and Space Systems Group.
MATHEMATICAL METHODS IN FLEXIBLE SPACECRAFT DYNAMICS, VOLUME 1 Final Report
C. J. H. Williams, E. B. Crellin, and S. A. Gotts Dec. 1976 196 p refs 2 Vol.
(Contract ESTEC-2405/75-AK)
(ESS/SS-766-Vol-1; ESA-CR(P)-915-Vol-1) Avail: NTIS HC A09/MF A01

The present state of knowledge in the field of dynamics of flexible spacecraft is summarized. The word dynamics include deployment dynamics, stability of spin, response to attitude control torques, response to external disturbances, etc. The mathematical tools, analytical and numerical, which have been used to treat these problems are presented in detail and are critically compared with respect to their practical advantages and disadvantages.
Author (ESA)

N77-23189# British Aircraft Corp. (Operating) Ltd., Bristol (England). Electronics and Space Systems Group.
MATHEMATICAL METHODS IN FLEXIBLE SPACECRAFT DYNAMICS, VOLUME 2 Final Report
C. J. H. Williams, E. B. Crellin, and S. A. Gotts Dec. 1976 286 p refs 2 Vol.
(Contract ESTEC-2405/75-AK)
(ESS/SS-766-Vol-2; ESA-CR(P)-915-Vol-2) Avail: NTIS HC A13/MF A01

For abstract, see N77-23188.

N77-23190# Martin Marietta Aerospace, Orlando, Fla.
EVALUATION OF CONAP CONCEPT FOR ADVANCED ABM NOSETIPS Final Report, 29 May 1974 - 30 Jun. 1976
Archie Ossin and Paul Kendall Nov. 1976 97 p refs
(Contract DAAG46-74-C-0128; DA Proj. 1W1-62113-A-661)
(AD-A033726; OR-14228; AMMRC-CTR-76-38) Avail: NTIS HC A05/MF A01 CSCL 16/3

This document reports the results of a 25-month research study, entitled 'Evaluation of CONAP concept for Advanced ABM Nosetips.' This program evaluated the performance of the Controlled Atmosphere Protection (CONAP) concept in active oxidation protection of a hot refractory metal, transpiration cooled nose tip for future application in an Advanced Interceptor Missile system. The specific objectives of this program were to build, process, test, and evaluate three-dimensional porous tungsten, sphere-cone nosetips at the Wright-Patterson 50 MW Plasma Arc Facility. In addition, the program evaluated distributed discrete hole models in the Martin Marietta Ramburner Facility. The porous tungsten nosetips, tested in the 50 MW Plasma Arc Facility, were processed porous tungsten made from Sylvania Tungsten-Copper (80 v/o W - 20 v/o Cu), manufactured to SPRINT Specification 11181124. This material selection was based on the results of previous work accomplished under AMMRC Contract DAAG46-73-C-0053 where several porous tungsten materials were characterized for flow properties and internal heat transfer characteristics. The results of these tests showed that the CONAP Concept was viable; however, further development at the porous tungsten material will be required for use in a flight environment. A significant result of the evaluation of the discrete hole concepts was that a departure from the ordinary sphere-cone configuration was advantageous in terms of requiring a minimum flow for survival. Author (GRA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N77-23191*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ROCKET CALIBRATION OF THE NIMBUS 6 SOLAR CONSTANT MEASUREMENTS
Charles H. Duncan, Royal G. Harrison (JPL), John R. Hickey, James M. Kendall, Jr. (JPL), Matthew P. Thekaekara, and Richard C. Willson (JPL) Mar. 1977 34 p refs Submitted for publication
(NASA-TM-X-71305; X-942-77-66) Avail: NTIS HC A03/MF A01 CSCL 14B

Total solar irradiance was observed simultaneously outside the earth's atmosphere by three types of absolute cavity radiometers and duplicates of four of the Nimbus 6 Earth Radiation Budget (ERB) solar channels in a June 1976 sounding rocket experiment. The preliminary average solar constant result from the cavity radiometers is 1367 Wm (-2) with an uncertainty of less than + or - 0.5% in S.I. units. The duplicate ERB channel 3 on the rocket gave a value of 1389 Wm (-2) which agreed exactly with the Nimbus 6 ERB channel 3 measurement made simultaneously with the rocket flight. Author

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N77-23192*# Hughes Research Labs., Malibu, Calif.
MODULARIZED ION THRUSTER Final Report, 3 Dec. 1975 - 13 Aug. 1976
J. Hyman, Jr. and C. R. Dulgeroff Nov. 1976 74 p refs
(Contract NAS3-19691)
(NASA-CR-134667) Avail: NTIS HC A04/MF A01 CSCL 21C

A modularized ion thruster system was developed for space-propulsion applications. Separate discharge chamber modules (DCMs) were optimized for operation at the thrust levels of T = 0.5 mlb and T = 2 mlb to accommodate the extended thrust range. These optimizations included modifications in the discharge-chamber components and the incorporation of ion machined accelerators in the beam-extraction systems. Performance of the optimized modules are summarized. Author

N77-23193*# M&S Computing, Inc., Huntsville, Ala.
TVC ACTUATOR MODEL Final Report
R. W. Baslock 10 Mar. 1977 142 p refs
(Contract NAS8-32113)
(NASA-CR-150260; Rept-77-020) Avail: NTIS HC A07/MF A01 CSCL 21H

A prototype Space Shuttle Main Engine (SSME) Thrust Vector Control (TVC) Actuator analog model was successfully completed. The prototype, mounted on five printed circuit (PC) boards, was delivered to NASA, checked out and tested using a modular replacement technique on an analog computer. In all cases, the prototype model performed within the recording techniques of the analog computer which is well within the tolerances of the specifications. Author

N77-23194*# Aerojet Liquid Rocket Co., Sacramento, Calif.
ADVANCED HIGH PRESSURE ENGINE STUDY FOR MIXED-MODE VEHICLE APPLICATIONS Final Report
W. P. Luscher and J. A. Mellish Jan. 1977 319 p refs
(Contract NAS3-19727)
(NASA-CR-135141) Avail: NTIS HC A14/MF A01 CSCL 21H

High pressure liquid rocket engine design, performance, weight, envelope, and operational characteristics were evaluated for a variety of candidate engines for use in mixed-mode, single-stage-to-orbit applications. Propellant property and performance data were obtained for candidate Mode 1 fuels which included: RP-1, RJ-5, hydrazine, monomethyl-hydrazine, and methane. The common oxidizer was liquid oxygen. Oxygen, the candidate Mode 1 fuels, and hydrogen were evaluated as thrust chamber coolants. Oxygen, methane, and hydrogen were found to be the most viable cooling candidates. Water, lithium, and sodium-potassium were also evaluated as auxiliary coolant systems. Water proved to be the best of these, but the system was heavier than those systems which cooled with the engine propellants. Engine weight and envelope parametric data were

established for candidate Mode 1, Mode 2, and dual-fuel engines. Delivered engine performance data were also calculated for all candidate Mode 1 and dual-fuel engines. Author

N77-23195# Fulmer Research Inst. Ltd., Stoke Poges (England).
MANUFACTURE OF ARRAYS FOR THE FIELD EMISSION THRUSTER Final Report
R. Parkes, L. A. Archibald, and D. Stewart Jul. 1976 46 p refs
(Contract ESA-2116/73-AK)
(ESA-CR(P)-909) Avail: NTIS HC A03/MF A01

Nickel and tungsten arrays for use as field emitting edges were developed for evaluation in a liquid cesium thruster. These arrays were made with point densities between 10 and 400 points/cm and tip radii between 0.3 and 10 micron. The methods used to produce the tip radii are all based upon electrochemical machining. An alternative method of using ion beam machining did not prove successful in producing the tip radii required or improving the surface finish of emitting tips. Author (ESA)

N77-23196# AeroChem Research Labs., Inc., Princeton, N. J.
CHEMICAL KINETIC/GAS DYNAMIC/PARTICLE INTERACTIONS IN ROCKET NOZZLE AND EXHAUST PLUME FLOWS Final Report, 1 Sep. 1973 - 30 Sep. 1976
Harold S. Pergament and Roger D. Thorpe Sep. 1976 13 p refs
(Contract F44620-74-C-0006)
(AD-A032675; AeroChem-TP-345; AFOSR-76-1143TR) Avail: NTIS HC A02/MF A01 CSCL 21/8

A review of the accomplishments achieved under this AFOSR contract is presented. Among the most notable are: (1) the development and demonstration of a fully-coupled rocket nozzle code (FULLNOZ) which, in calculating nozzle flow properties, couples the effects of nonequilibrium chemistry, gas/particle thermal and dynamic nonequilibrium, turbulent mixing across streamtubes and turbulent wall boundary layers; and (2) the development of a phenomeno-logical model for the interpretation of IR radiation data from subscale liquid propellant rocket motor plumes; the model accounts for the effects of unburned fuel on rocket nozzle and after-burning plume properties. GRA

N77-23197# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
FEASIBILITY TEST OF A PULSE MODULATED PRESSURIZATION SYSTEM FOR A HIGH ALTITUDE SUPERSONIC TARGET VEHICLE PROPULSION SYSTEM Final Report
John E. Branigan and David Hamilton Nov. 1976 48 p refs
(AD-A032735; AFRPL-TR-76-73) Avail: NTIS HC A03/MF A01 CSCL 21/8

Feasibility testing was conducted on a pulse-modulated pressurization system consisting of a solenoid valve powered directly by a normally closed pressure switch. The system was tested for stability of operation and accuracy of pressure control, using a High Altitude Supersonic Target (HAST) oxidizer tank and high pressure GN2 storage vessel. Outflow tests which simulated a wide range of HAST vehicle mission duty cycles showed the system to be stable and accurate to approximately the deadband of the pressure switch used, 2 psi. Author (GRA)

N77-23198# Missouri Univ., Rolla. Dept. of Physics.
KINETIC REACTION COEFFICIENTS IN ROCKET EXHAUST PLUMES Interim Report, 1 Jul. 1975 - 30 Jun. 1976
William R. Snow, Laird D. Schearer, Kaare J. Nygaard, and R. J. Corbin Aug. 1976 21 p refs
(Grant AF-AFOSR-2672-74; AF Proj. 9750)
(AD-A032863) Avail: NTIS HC A02/MF A01 CSCL 21/8

This report describes progress in the experimental program to measure reaction rates for the following reactions: (1) HCl + e yields H + Cl(-) K + Cl yields K(+) - Cl(-) (3) K(+) + e + M yields K + M. Measurement of the rate for (1) has been complicated by the large rates for clustering reactions (4) Cl(-) + HCl + M yields (ClxHCl) (-)+M. The equivalent attachment coefficient for the first cluster formation (n superscript n + 1) is given as a function of E/p. Performance of a crossed molecular beam apparatus for measurement of the energy dependence of collisional ionization of potassium and atomic chlorine (2) is described. The experimental technique to be used to measure three body recombination in potassium is described. This technique utilizes a laser induced, two step photoionization process which has been demonstrated in cesium. GRA

N77-23199# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.
SURVEILLANCE REPORT. STAGE 1 DISSECTED MOTORS. PHASE 8: PROPONENT AND COMPONENT TESTING Quarterly Report
John A. Thompson Oct. 1976 76 p
(AD-A032815; MANCP-358(76)) Avail: NTIS HC A05/MF A01 CSCL 21/8

Testing was performed to determine the useful shelf/service life for LGM-30 Stage I Rocket Motors. A three year storage program for propellant and components was started in May of 1961. This program was then extended to a ten year study and later continued indefinitely to assure that deterioration in motor physical characteristics could be detected in time to take some corrective actions before the weapon system performance deteriorated below an acceptable level. This report covers only propellant data and limited case bond data. The mal-function of an environmental chamber and the inadvertent burning of motors during dissection destroyed component samples that had originally been part of this testing program. Dissection of selected motors in the future will provide samples for continued component testing. Test specimens for this reporting period were obtained from motors STM-012, 0012099, 0012199 and UP7775 block propellant. The data from this test period are combined with data from previous testing and entered into the G085 computer for storage, analysis, and regression analysis. From the statistical anaysis of all data tested to date, significant degradation of the propellant does not appear likely for at least two years past the oldest data point. Author (GRA)

N77-23200# Purdue Univ., Lafayette, Ind.
INVESTIGATION TO EXTEND THE APPLICABILITY OF LASER RAMAN SCATTERING DIAGNOSTIC TECHNIQUES TO PRACTICAL COMBUSTION SYSTEMS Annual Report, 26 Jan. - 31 Aug. 1976
Alan C. Eckbreth 13 Sep. 1976 12 p refs Prepared by United Technologies Res. Center, East Hartford, Conn.
(Contract N00014-75-C-1143; Proj. SQUID; NR Proj. 098-033)
(AD-A032493; SQUID-TR-UTRC-3-PU) Avail: NTIS HC A02/MF A01 CSCL 20/5

Laser Raman scattering diagnostic techniques may be precluded from application to practical combustion devices due to a variety of laser-particulate (soot) interaction 'noise' effects. Under the subject contract the laser particulate interaction has been studied in some detail. Laser induced particulate temperatures have been measured as a function of laser flux and are found to agree fairly well with an analytical model. The scaling of the absolute noise has been studied and the noise has been found to saturate with increasing laser energy and decrease with decreasing focal length lenses. The effect of signal averaging pulsed Raman data obtained in an unsteady medium has been analyzed. Averaged Raman data is shown to depend not only on average temperature but on the magnitudes and correlations of medium fluctuations in density and temperature. Noise sampling and subtraction have been shown to be feasible, and a temperature measurement demonstration was performed on a soot seeded laboratory burner using the above approach.
Author (GRA)

N77-23201# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
STRUCTURAL COMPUTER CODE EVALUATION, VOLUME 1 Final Report, Jul. 1975 - Aug. 1976
E. L. Jeter Nov. 1976 77 p refs Prepared by Naval Weapons Center, China Lake, Calif. 2 Vol.
(AF Proj. 3059)
(AD-A034186; AFRPL-TR-76-68-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 21/8

This report summarizes the first phase of a study of nonlinear structural analysis computer codes for rocket nozzle stress analysis. A brief summary of nonlinear structural mechanics is given, along with a discussion of features desired for rocket nozzle thermomechanical stress analysis. Several computer codes are evaluated, and four codes are selected for further study in a subsequent phase of this work. Two of the selected codes employed linear

elastic material behavior, while the remaining codes employed fully nonlinear behavior. The codes selected for this study were SAAS III, TEXGAP, NONSAP, and NEPSAP. It should be noted that none of the codes selected for this study contained all of the features desired for structural analysis of modern rocket nozzles; however, it is anticipated that future versions of these codes will contain the desired features. GRA

N77-23202# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
STRUCTURAL COMPUTER CODE EVALUATION, VOLUME 2 Final Report, Jul. 1975 - Aug. 1976
Joseph H. Hildreth Nov. 1976 75 p Prepared by Naval Weapons Center, China Lake, Calif. 2 Vol.
(AF Proj. 3059)
(AD-A034187; AFRPL-TR-76-68-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 21/8

This document is Volume 2 of the final report on the evaluation of current structural computer codes. This program was a joint effort between the Naval Weapons Center and the Air Force Rocket Propulsion Lab to determine the capabilities of current structural codes versus the capabilities needed to analyze state of the art solid rocket nozzles. The project was intended to be a first step of a continuing evaluation process as newer codes become available. The work consisted of a survey of available structural codes, an evaluation of their theoretical capabilities, installation of 4 codes on RPL's computer, and 4 analyses and results, and conclusions of the program are presented in this volume. Author (GRA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N77-23203# Georgetown Univ., Washington, D.C. Dept. of Chemistry.
SYNTHESIS AND STRUCTURE OF HEXAMOLYBDOBISORGANOARSONATES
W. Kwak, L. M. Rajdovic, J. K. Stalick, M. T. Pope, and C. O. Quicksall Nov. 1976 18 p refs Submitted for publication
(Contract N00014-75-C-0945; NR Proj. 053-576)
(AD-A032545; TR-6) Avail: NTIS HC A02/MF A01 CSCL 07/3

As part of the program to investigate the chemistry of organic derivatives of heteropolyoxometallate complexes, molybdenum complexes of monoalkyl- and arylphosphonates, RPO3(2-) and dialkyl- and arylarsinates R2AsO2(-) were described. The synthesis, solution properties, and structure of a series of polymolybdate anions based on monoalkyl- and arylarsonates RAsO3(2-) are reported. GRA

N77-23204# Air Force Eastern Test Range, Patrick AFB, Fla.
EVALUATION OF SELECTED SAMPLES OF RETROREFLECTIVE MATERIAL FOR USE IN LASER TRACKING OF C3 AND C4 MISSILES Final Report
Stuart N. Mapes Oct. 1976 13 p refs
(AD-A034067; HFETR-TR-76-17) Avail: NTIS HC A02/MF A01 CSCL 16/4

The objective of this report is to determine which type of reflective material, paint or tape, would be better to use on C3 and C4 missiles for laser tracking. Author (GRA)

24 COMPOSITE MATERIALS

Includes laminates.

N77-23205 Utah Univ., Salt Lake City.
THE DEVELOPMENT OF FIBER REINFORCED POLYMER COMPOSITES FOR ORTHOPEDIC APPLICATIONS Ph.D. Thesis
Gregory Born McKenna 1976 389 p
Avail: Univ. Microfilms Order No. 77-4243

Using the fracture fixation plate as a model system, three areas of investigation were undertaken to demonstrate how the composite mechanical versatility offers an improvement over the metallic materials currently in use and to develop basic data concerning the suitability of several fiber and polymer systems for orthopedic applications. The first area of investigation was the mechanical interactions between the bone plate and the bone. Because the effects of bone plate flexural rigidity on fracture healing were unknown, an implant program using composite and metal fracture fixation plates having a wide range of flexural rigidities to plate transverse osteotomies of canine femora was undertaken. Material in vitro degradation resistance was studied using PECF and autoclave tests. From these results only the polypropylene based composites appear not to degrade.
Dissert. Abstr.

N77-23206*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
A COMPARISON OF SIMPLE SHEAR CHARACTERIZATION METHODS FOR COMPOSITE LAMINATES Interim Report, 1 Oct. 1975 - 30 Sep. 1976
Y. T. Yeow and H. F. Brinson Feb. 1977 29 p refs
(Grant NsG-2038)
(NASA-CR-152708; VPI-E-77-7) Avail: NTIS HC A03/MF A01 CSCL 11D

Various methods for the shear stress-strain characterization of composite laminates are examined, and their advantages and limitations are briefly discussed. Experimental results and the necessary accompanying analysis are then presented and compared for three simple shear characterization procedures. These are the off-axis tensile test method, the [+ or - 45 deg]s tensile test method and the [0 deg/90 deg]s symmetric rail shear test method. It is shown that the first technique indicates that the shear properties of the G/E laminates investigated are fundamentally brittle in nature while the latter two methods tend to indicate that the G/E laminates are fundamentally ductile in nature. Finally, predictions of incrementally determined tensile stress-strain curves utilizing the various different shear behavior methods as input information are presented and discussed.
Author

N77-23207*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TECHNIQUES FOR INCREASING BORON FIBER FRACTURE STRAIN
J. A. DiCarlo 1977 31 p refs Presented at 106th Ann. Meeting of the Am. Inst. of Mining, Metallurgical, and Petroleum Engr., Atlanta,Ga., 6-10 Mar. 1977
(NASA-TM-X-/3627; E-9119) Avail: NTIS HC A03/MF A01 CSCL 11D

Improvement in the strain-to-failure of CVD boron fibers is shown possible by contracting the tungsten boride core region and its inherent flaws. The results of three methods are presented in which etching and thermal processing techniques were employed to achieve core flaw contraction by internal stresses available in the boron sheath. After commercially and treatment induced surface flaws were removed from 203 micrometers (8 mil) fibers, the core flaw was observed to be essentially the only source of fiber fracture. Thus, fiber strain-to-failure was found to improve by an amount equal to the treatment induced contraction on the core flaw. Commercial feasibility considerations suggest as the most cost effective technique that method in which as-produced fibers are given a rapid heat treatment above 700 C. Preliminary results concerning the contraction kinetics and fracture behavior observed are presented and discussed both for high vacuum and argon gas heat treatment environments.
Author

N77-23208*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TEN DEG OFF-AXIS TEST FOR SHEAR PROPERTIES IN FIBER COMPOSITES
C. C. Chamis and J. H. Sinclair 1977 14 p refs Presented at Spring Meeting of the Soc. for Experimental Stress Analysis, Dallas, Tex., 15-20 May 1977
(NASA-TM-X-73550; E-8577) Avail: NTIS HC A02/MF A01 CSCL 11D

A combined theoretical and experimental investigation was

conducted to assess the suitability of the 10 deg off-axis tensile test specimen for the intralaminar shear characterization of unidirectional composites. Composite mechanics, a combined-stress failure criterion, and a finite variation across the specimen width and the relative stress and strain magnitudes at the 10 deg plane. Strain gages were used to measure the strain variation across the specimen width at specimen midlength and near the end tabs. Specimens from Mod-I/epoxy, T-300/epoxy, and S-glass/epoxy were used in the experimental program. It was found that the 10 deg off-axis tensile test specimen is suitable for intralaminar shear characterization, and it is recommended that it should be considered as a possible standard test specimen for such a characterization. Author

N77-23209*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL DEGRADATION OF THE TENSILE STRENGTH OF UNIDIRECTIONAL BORON/ALUMINUM COMPOSITES
H. H. Grimes, R. A. Lad, and J. E. Maisel 1977 17 p refs Presented at Spring Meeting of the Metals Soc. of the Am. Inst. of Mining, Metallurgical and Petroleum Engrs., Atlanta, Ga., 6-11 Mar. 1977
(NASA-TM-X-73614; E-9097) Avail: NTIS HC A02/MF A01 CSCL 11D

The variation of ultimate tensile strength with thermal treatment of B-Al composite materials and of boron fibers chemically removed from these composites in an attempt to determine the mechanism of the resulting strength degradation was studied. Findings indicate that thermally cycling B-Al represents a more severe condition than equivalent time at temperature. Degradation of composite tensile strength from about 1.3 GN/m squared to as low as 0.34 GN/m squared was observed after 3,000 cycles to 420 C for 203 micrometers B-1100 Al composite. In general, the 1100 Al matrix composites degraded somewhat more than the 6061 matrix material studied. Measurement of fiber strengths confirmed a composite strength loss due to the degradation of fiber strength. Microscopy indicated a highly flawed fiber surface. Author

N77-23210*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ULTRASONIC EVALUATION OF THE STRENGTH OF UNIDIRECTIONAL GRAPHITE-POLYIMIDE COMPOSITES
A. Vary and K. J. Bowles 1977 27 p refs Presented at 11th Symp. on Nondestructive Evaluation, San Antonio, 20-22 Apr. 1977; sponsored by Am. Soc. for Nondestructive Testing and Southwest Res. Inst.
(NASA-TM-X-73646; E-9153) Avail: NTIS HC A03/MF A01 CSCL 11D

An acoustic-ultrasonic method is described that was successful in ranking unidirectional graphite-polyimide composite specimens according to variations in interlaminar shear strength. Using this method, a quantity termed the stress wave factor was determined. It was found that this factor increases directly with interlaminar shear strength. The key variables in this investigation were composite density, fiber weight fraction, and void content. The stress wave factor and other ultrasonic factors that were studied were found to provide a powerful means for nondestructive evaluation of mechanical strength properties. Author

N77-23211*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
ANALYSIS OF SHEAR TEST METHOD FOR COMPOSITE LAMINATES Interim Report
Henry W. Bergner, Jr., John G. Davis, Jr., and Carl T. Herakovich Apr. 1977 141 p refs
(Grant NGR-47-004-129)
(NASA-CR-152704; VPI-E-77-14; IR-6) Avail: NTIS HC A07/MF A01 CSCL 11D

An elastic plane stress finite element analysis of the stress distributions in four flat test specimens for in-plane shear response of composite materials subjected to mechanical or thermal loads is presented. The shear test specimens investigated include: slotted coupon, cross beam, losipescu, and rail shear. Results are presented in the form of normalized shear contour plots for all three in-plane stess components. It is shown that the cross beam, losipescu, and rail shear specimens have stress distributions which are more than adequate for determining linear shear behavior of composite materials. Laminate properties, core effects, and fixture configurations are among the factors which were found to influence the stress distributions. Author

N77-23212# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
DEFECT PROPERTY RELATIONSHIPS IN COMPOSITE MATERIALS Annual Report, 3 Feb. 1975 - 3 Jan. 1976
K. L. Reifsnider, E. G. Henneke, and W. W. Stinchcomb Wright-Patterson AFB, Ohio AFML Apr. 1976 52 p refs
(Contract F33615-75-C-5119)
(AD-A031809; AFML-TR-76-81) Avail: NTIS HC A04/MF A01 CSCL 11/4

This report describes the initial results of an investigation which has as its objectives the determination of the nature of damage in two graphite-epoxy (GEp) laminates under various combinations of loading as completely and precisely as possible, and the investigation of the corresponding mechanical property changes. The results include several new findings, the development of unique investigative methods, and substantial deviations from the predictions of common models. Author (GRA)

N77-23213# Army Materials and Mechanics Research Center, Watertown, Mass.
INVESTIGATION OF ENVIRONMENTAL DETERIORATION ON NOMEX HONEYCOMB COMPOSITES
John R. Plumer, Michael A. Kornitzky, and Elizabeth Goeke Jul. 1976 16 p
(DA Proj. 1T1-62105-AH-84)
(AD-A033252; AMMRC-TR-76-23) Avail: NTIS HC A02/MF A01 CSCL 13/13

This study investigates the response of Nomex honeycomb, an aircraft construction material, to external environmental influences. The objective is to determine the changes in mechanical properties of Nomex honeycomb, both as bare honeycomb and as part of a composite structure, due to exposure to a high-temperature, high-humidity environment. Static compression and plate shear mechanical tests were performed to assess effects of temperature and humidity. In addition, moisture uptake was determined. Shear strength was found to be only slightly affected by the test conditions; compressive strength was not affected; water uptake is 2% by weight. Author (GRA)

N77-23214# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
THE SURFACE COMPOSITION AND ENERGETICS OF TYPE A GRAPHITE FIBERS Final Report, May 1975 - Feb. 1976
Lawrence T. Drzal, Judith A. Mescher, and William L. Baun Sep. 1976 66 p refs
(AF Proj. 7340)
(AD-A034203; AFML-TR-76-148) Avail: NTIS HC A04/MF A01 CSCL 11/4

This report documents the results of an in-house program to determine what type of interactions occur between graphite reinforcing fiber and the polymeric matrix in advanced composites and how these interactions effect interfacial mechanical properties and durability. Surface treatments applied to Type A fiber of PAN-based material increase the surface energetics as measured by krypton adsorption on 30 percent of the surface. In addition, the affinity of the treated surface is increased for adsorption of typical ambient gases over the untreated surface by a factor of eight. Finally, the surface of this fiber contains a significant amount of sodium which affects the fiber surface properties. GRA

N77-23215# Naval Surface Weapons Center, White Oak, Md.
THE EFFECT OF MOISTURE ON CARBON FIBER REINFORCED EPOXY COMPOSITES. 1. DIFFUSION Technical Report, 1 Jul. 1974 - 1 Jan. 1976
Joseph M. Augl and Alan E. Berger 27 Sep. 1976 77 p
(AD-A034787; NSWC/WOL/TR-76-7) Avail: NTIS HC A05/MF A01 CSCL 11/4

Mathematical models are suggested for calculating the reduced moisture diffusivities in unidirectional carbon fiber reinforced composites with hexagonal and tetragonal fiber alignment, parallel and perpendicular to the fiber direction, as a function of fiber volume fraction. The effective diffusion coefficients

measured perpendicular to the fiber direction of 6 carbon fiber composites were determined as a function of temperature and relative humidity. The knowledge of the diffusion coefficients as a function of temperature, relative humidity, fiber volume fraction and composite geometry allow the prediction of the internal moisture distribution in a composite if the environment can be specified. A few simple examples have been illustrated.
Author (GRA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N77-23216 California Univ., San Diego.
INVESTIGATIONS INTO THE THEORY AND APPLICATIONS OF FLUCTUATION SPECTROSCOPY Ph.D. Thesis
Michael Benjamin Weissman 1976 168 p
Avail: Univ. Microfilms Order No. 77-4224

Experimental and theoretical investigations into the applications and theory of fluctuation spectroscopy are presented. An experimental determination of chemical reaction rates from fluctuations in the concentrations of the reactants monitored conductimetrically is described. A method for determining macromolecular molecular weights by concentration fluctuations is described, along with its experimental verification in the determination of DNA molecular weights by fluorescence fluctuations. The feasibility of determining concentrations by optical density fluctuations is demonstrated experimentally. The fundamental thermodynamic enthalpy fluctuations are demonstrated quantitatively by a conductometric method. Dissert. Abstr.

N77-23217 California Univ., Berkeley.
ELECTROCHEMICAL SYSTEMS: IMPEDANCE OF A ROTATING DISK AND MASS TRANSFER IN PACKED BEDS Ph.D. Thesis
Peter Willem Appel 1976 168 p
Avail: Univ. Microfilms Order No. 77-4363

The impedance of a rotating disk is calculated under conditions where the time average current to the disk is below the limiting current. The reaction at the surface of the disk is of the redox type; consequently the influence of product concentrations on the disk impedance was included in the calculations. The double-layer theory is used to calculate the surface excesses of all ionic species present in the solution. It is shown that the concentration fluctuations of both cation and anion of the supporting electrolyte caused by migration are of the same order of magnitude as the concentration fluctuations of reactant and product. The application of the limiting-current technique to mass-transfer studies of packed beds at very low Peclet numbers is described. Dissert. Abstr.

N77-23218 Vanderbilt Univ., Nashville, Tenn.
ESTABLISHING CRITERIA FOR IGNITION: AN EXPERIMENTAL AND THEORETICAL STUDY OF THE EFFECT OF SPARK GEOMETRY ON THE MINIMUM IGNITION ENERGY OF HYDRAZINE Ph.D. Thesis
John Robert Overley 1976 200 p
Avail: Univ. Microfilms Order No. 77-6113

The effect of spark geometry on the minimum ignition energy (Emin) of hydrazine vapor was studied theoretically and experimentally. Variations in the theoretical steady-state flame speed due to changes in the reaction kinetics and physical properties were also studied. The effects of spark elongation on subsequent propagation or extinction of the flame was explored by casting the unsteady laminar flame equations in prolate spheroidal coordinates and solving numerically using a Crank-Nicholson algorithm. Dissert. Abstr.

N77-23219 Wisconsin Univ., Madison.
LASER RAMAN SPECTROSCOPY OF ADSORBED SPECIES: PYRIDINE AND N-BUTENES ON SILICA GEL Ph.D. Thesis
Glenn LaRue Schrader, Jr. 1976 187 p
Avail: Univ. Microfilms Order No. 76-28938

Laser Raman spectroscopy was applied to the study of adsorbed species. The experimental equipment and technique were applicable to systems using powder or pellet adsorbents. The pyridine-silica gel system study indicated that pyridine is adsorbed on the surface of silica gel in two different forms. At high coverages, the spectra indicated that a physically adsorbed form of pyridine closely resembling liquid pyridine was present. Raman spectra of the n-butene isomers adsorbed on silica gel were also recorded. They indicated that the bonding of the isomers to the silica gel surface was relatively weak. Dissert. Abstr.

N77-23220 California Univ., Berkeley.
STUDY OF EXOTHERMIC PROCESSES IN COMBUSTION Ph.D. Thesis
James Michael Short 1976 124 p
Avail: Univ. Microfilms Order No. 77-4601

Nonsteady flow fields generated by exothermic reaction in a compressible medium were analyzed. The solution requires integration of a set of chemical kinetic rate equations combined with the conservation equations of nonsteady gasdynamics expressed in Lagrangian form. The hypothesis is that the power pulse of exothermic energy is so short that diffusion, viscosity, and conductivity are negligible. The effect of the power pulse may be restricted to discrete Lagrangian cells. First application of the model to hydrocarbon combustion is accomplished. A stoichiometric methane oxygen mixture, $CH4 + 2\ O2 + 27\ Ar$ is analyzed. Results of analysis are compared with experiments performed in a shock tube using the reflected shock technique. A method for estimating concentration histories in individual Lagrangian cells is presented. Dissert. Abstr.

N77-23221*# Athens Coll., Ala.
CHEMICAL ANALYSIS OF OUTGASSING CONTAMINANTS ON SPACECRAFT SURFACES Final Report
Ronald C. McNutt 5 Dec. 1976 56 p
(Contract NAS8-28058)
(NASA-CR-150261) Avail: NTIS HC A04/MF A01 CSCL 07D

Samples of S-13 paint on aluminum, reflection grating anomalies as affected by dielectric coatings, and rocket effluents were analyzed along with Skylab window scrapings and a gas activated semiconductor. Development of an HCl detector is also discussed. Results are briefly summarized. J.M.S.

N77-23222*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEVELOPMENT OF A DRIFT-CORRECTION PROCEDURE FOR A DIRECT-READING SPECTROMETER
Gilbert B. Chapman, II and William A. Gordon Washington May 1977 23 p refs
(NASA-TN-D-8463; E-9004) Avail: NTIS HC A02/MF A01 CSCL 14B

A procedure which provides automatic correction for drifts in the radiometric sensitivity of each detector channel in a direct-reading emission spectrometer is described. Such drifts are customarily controlled by the regular analyses of standards, which provide corrections for changes in the excitational, optical, and electronic components of the instrument. This standardization procedure, however, corrects for the optical and electronic drifts. It is a step that must be taken if the time, effort, and cost of processing standards is to be minimized. This method of radiometric drift correction uses a 1,000-W tungsten-halogen reference lamp to illuminate each detector through the same optical path as that traversed during sample analysis. The responses of the detector channels to this reference light are regularly compared with channel response to the same light intensity at the time of analytical calibration in order to determine and correct for drift. Except for placing the lamp in position, the procedure is fully automated and compensates for changes in spectral intensity due to variations in lamp current. A discussion of the implementation of this drift-correction system is included. Author

N77-23223# Utah Univ., Salt Lake City. Dept. of Chemistry.
DEPOLARIZED RAYLEIGH SCATTERING AND ORIENTATIONAL MOTION OF POLYETHYLENE GLYCOL
Dane R. Jones (Calif. Polytech. State Univ., San Diego) and C. H. Wang 6 Oct. 1976 29 p refs Submitted for publication
(Contract N00014-75-C-0908; NR Proj. 051-562)
(AD-A031896; TR-12) Avail: NTIS HC A03/MF A01 CSCL 07/4

The depolarized Rayleigh light scattering spectra of pure polyethylene clycols and their solutions in an optically isotropic solvent were studied as a function of polymer molecular weight, concentration and temperature. Reorientational relaxation times were obtained by fitting the observed spectra to Lorentzian functions convoluted with the experimental spectrum. The relaxation times were found to increase with increasing molecular weight and with dilution. The depolarized Rayleigh results for the polyethylene glycols were compared with results for other polymer systems and with results obtained using other types of relaxation studies. By studying the dependence of the relaxation times on viscosity, temperature and concentration and comparing the results with theoretical predictions of molecular and end-group reorientations, the depolarized Rayleigh spectra of polyethylene glycol is associated with the rotation of the entire polymer molecule. Author (GRA)

N77-23224# Kentucky Univ., Lexington.
GAS ADSORPTION BY ACTIVATED AND IMPREGNATED CARBONS Quarterly Status Report, Apr. - Jul. 1976
P. J. Reucroft and C. P. Madhusudhan Sep. 1976 27 p refs
(Contract DAAA15-74-C-0163; DA Proj. 1W7-62710-A-095)
(AD-A031930; ED-CR-76092; QSR-9) Avail: NTIS HC A03/MF A01 CSCL 07/4

In the period reported, equilibrium adsorption isotherms have been measured for CCl4 on carbons 4, 5, and 6. The results have been analyzed in terms of the Dubinin-Polanyi isotherm equation and compared with those obtained for carbons 1, 2, and 3. A brief description of the nature of the impregnants in carbons 3, 4, 5, and 6 is given. The results indicate that CCl4 adsorption on these carbons proceeds by a physical process and that Dubinin-Polanyi considerations apply in all these carbons. GRA

N77-23225# Stanford Research Inst., Menlo Park, Calif.
PHOTODISSOCIATION SPECTROSCOPY OF CO3(-)* Interim Report, 1 Jan. - 31 Dec. 1975
J. T. Moseley, P. C. Cosby, and J. R. Peterson Nov. 1976 31 p refs
(Contract DAHC04-73-C-0016; Grant NSF MPS-75-10085; DA Proj. 1T1-62111-AH-71; DA Proj. 1T1-621102-B-53A)
(AD-A032444; BRL-CR-321) Avail: NTIS HC A03/MF A01 CSCL 20/8

The photodissociation cross section of the carbon trioxide negative ion has been measured over the wavelength range from 457.9 nm to 694.0 nm, and reveals detailed structure reflecting the vibrational spacings of the predissociating excited electronic state. From an analysis of the structure, three vibrational modes of the excited state having energies of 900/cm, 1470/cm, and 880/cm were identified. The bond energy of the carbon trioxide negative ion (to separation into a carbon dioxide molecule and an atomic oxygen negative ion) was determined to be 1.8 + or - 0.1 eV and the electron affinity of carbon trioxide was found to be 2.9 + or - 0.3 eV. By comparison with theoretical calculations, the lowest predissociating state was identified as the one doublet A one state. Observations regarding other excited states of the carbon trioxide negative ion are made.
Author (GRA)

N77-23226# National Bureau of Standards, Washington, D. C. Inst. for Materials Research.
A NUMERICAL SOLUTION OF THE TIME DEPENDENT PARTIAL DIFFERENTIAL EQUATIONS WHICH DESCRIBE A ONE-DIMENSIONAL, LAMINAR, PREMIXED FLAME Final Report
R. L. Brown Jan. 1976 178 p refs
(PB-263100/0; NBSIR-76-994) Avail: NTIS HC A09/MF A01 CSCL 21B

The set of time dependent, parabolic differential equations, which describes the physical and chemical processes in a one-dimensional, laminar, premixed flame, is solved by adapting a solution procedure developed to solve the two-dimensional steady state boundary layer equations. The flame equations are integrated by an implicit method until the steady state is reached. Solution of the flame equations yields the concentration profiles of the different chemical species as well as the temperature profile. From these one can also calculate the production rates of each species, the rate of each chemical reaction, and the heat release rate at each point in the flame. GRA

N77-23227# IRT Corp., San Diego, Calif.
MASS-SPECTROMETRIC MEASUREMENTS OF ENHANCED METHANATION ACTIVITY OVER COBALT AND NICKEL FOILS Interim Report
Robert L. Palmer and David A. Vroom 20 Dec. 1976 23 p refs
(Contract N00014-72-C-0247)
(AD-A034675; INTEL-8005-007) Avail: NTIS HC A02/MF A01 CSCL 07/4

The kinetics of methane synthesis from H2/CO mixtures has been studied over Ni, Co, and Fe foils. The gas composition of a flowing reaction cell was analyzed using a differentially pumped, modulated mass-spectrometer. Ni and Co foils that have been previously oxidized, and then reduced in H2 at 525-600 K show a surprisingly high and specific catalytic activity for methane formation. No unusual activity was observed over iron for any of the surface treatments tried here. Evidence is also presented to support a mechanism for this highly specific reaction involving a labile surface carbon atom intermediate. Author (GRA)

N77-23228# National Standard Reference Data System.
SELECTED SPECIFIC RATES OF REACTIONS OF TRANSIENTS FROM WATER IN AQUEOUS SOLUTION. 3: HYDROXYL RADICAL AND PERHYDROXYL RADICAL AND THEIR RADICAL IONS
Farhataziz Ross and Alberta B. Ross Jan. 1977 126 p refs Prepared in cooperation with Notre Dame Univ., Ind.
(PB-263198/4; NSRDS-NBS-59-3; LC-72-600064) Avail: NTIS HC A07/MF A01 CSCL 07D

Rates of reactions of OH and HO2 with organic and inorganic molecules, ions, and transients in aqueous solution were tabulated, as well as the rates for the corresponding radical ions in aqueous solution (O-) and O2(-). Most of the rates were obtained by radiation chemistry methods, both pulsed and steadystate; data from photochemistry and thermal methods are also included. Rates for over one thousand reactions are listed. GRA

N77-23229# General Electric Co., Schenectady, N.Y. Corporate Research and Development.
INTERNATIONAL CONFERENCE ON SUPERIONIC CONDUCTORS: CHEMISTRY, PHYSICS, AND APPLICATIONS Final Report
G. D. Mahan and W. L. Roth 12 May 1976 70 p refs Proc. held at Schenectady, N. Y., 10-12 May 1976; sponsored by AFOSR, Am. Phys. Soc., EPRI, Electrochemical Soc., G. E. Co., and NSF
(Grant NSF DMR-76-01464)
(PB-262971/5) Avail: NTIS HC A04/MF A01 CSCL 20L

Electrochemistry, experimental probes, and specific materials such as beta aluminum and silver iodide are among the topics discussed. J.M.S.

N77-23230# Columbia Univ., New York. Dept. of Chemistry.
DETERMINATION OF ABSOLUTE PHOTON YIELDS IN CHEMILUMINESCENT REACTIONS Annual Technical Report, 3 Dec. 1975 - 2 Dec. 1976
Richard N. Zare Dec. 1976 41 p refs
(Contract N00014-76-C-0466; ARPA Order 2840)
(AD-A034515) Avail: NTIS HC A03/MF A01 CSCL 20/10

An experimental procedure is presented to measure the absolute photon yield, the percentage probability of emitting a visible photon per reactant molecule consumed, for chemiluminescent reactions under single collision conditions. Using a well-defined metal beam directed into a scattering gas at sub-millitorr pressures, this procedure is applied to the reactions Sm-N2O, Sm-F2, Ba-N2O, and Ba-NO2 to obtain the photon yields in the 350-800 nm range of 0.18%, 5.5%, 1.1%, and

0.08% respectively, where the estimated uncertainty is about 50%. Author (GRA)

N77-23231# Delaware Univ., Newark. Dept. of Chemistry.
COMBUSTION CHARACTERISTICS OF CRYSTALLINE SOLID OXIDIZERS AND LATTICE DYNAMICS IN AMMONIUM PERCHLORATE Final Report, 1 Jul. 1971 - 30 Jun. 1976
Thomas B. Brill Aug. 1976 58 p refs
(Grant AF-AFOSR-2131-71)
(AD-A032999; AFOSR-76-1176TR) Avail: NTIS HC A04/MF A01 CSCL 21/9

Combustion Characteristics of Crystalline Oxidizers: Time-of-flight and high resolution mass spectrometry of UHP-AP and its deuterated derivative were examined in an effort to identify some of the key decomposition species. Of particular interest is the sure detection of HNO, the hydrides of nitrogen and the oxides of chlorine. HNO (mass 31) was found as a minor component at temperatures above 80 C. It is considered highly improbable that HNO could have occurred by reactions other than surface thermal reactions. High resolution spectra were used to separate O2(2-) and O(-) from NH2 at mass 16. The presence of NH2(-) was confirmed along with NH4(-), NH3(-) and NH(-). HClO4(-), Cl(-) and all the simple oxides of chlorine were found but Cl2(-), HClO(-), HClO2(-), HClO3(-), and ClO4(-). Also not detected were N2(-), N2O(-) and NO2(-) in the condensed phase. No parent NH4ClO4(-) was present. Evidence of strong exothermic reactions in the condensed phase was found. Lattice Dynamics in AP: The breakdown of the crystal lattice of AP in the 300-625 K range was studied by laser Raman spectroscopy. Detailed examination of the external and internal modes of the ion reveals that the onset of essentially unhindered tumbling of the ClO4(-) ion seems to be intimately tied to the decomposition of AP. All vibrational modes found in AP including several not here-to-fore reported are discussed and insofar as possible assigned. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N77-23232 Missouri Univ., Columbia.
INFLUENCE OF MICROSTRUCTURAL AND LOAD WAVE FORM CONTROL ON FATIGUE CRACK GROWTH BEHAVIOR OF PRECIPITATION HARDENING STAINLESS STEELS Ph.D. Thesis
Kevin Richard Kondas 1976 255 p
Avail: Univ. Microfilms Order No. 77-5620

The experimental approach varied the heat treatment of two precipitation hardening martensitic alloys. Fatigue-crack growth data was correlated between materials cycled under wave forms of 10 Hz sine frequency and trapezoidal one minute hold-time for different stress range ratios and environments. The data are represented through four parameters of a unique functional curve that precisely applies mathematical boundary conditions to the physics of the fatigue-crack growth process. This contemporary Weibull-type mathematical method was demonstrated to be applicable to the quantification of microstructural effects on fatigue-crack growth. Dissert. Abstr.

N77-23233 Vanderbilt Univ., Nashville, Tenn.
FIELD INDUCED STRESSES IN FIELD ION EMITTERS Ph.D. Thesis
Harvill Carlton Eaton 1976 249 p
Avail: Univ. Microfilms Order No. 77-6105

The stress state in a field emitter is determined numerically. Both the shape and boundary conditions are derived from the micrograph. Employing numerical techniques and computer graphics, shape profiles of the emitter along selected crystallographic zones are obtained. The true shape of the emitter is found to be more complex than indicated by less sensitive techniques. The three-dimensional nature of the endform is best displayed by both transverse and longitudinal sections. The former, displayed in the form of an iso-elevation plot, reveals the form of the starting material from which the emitter is fabricated. The latter displays the crystallography of the material by revealing some of the more prominent crystal facets. Dissert. Abstr.

N77-23234 Oklahoma State Univ., Stillwater.
RELATIONSHIPS BETWEEN PROCESS VARIATION, NUCLEATION, AND THE MICROSTRUCTURE OF CASTINGS Ph.D. Thesis
Kenneth John Eger 1976 151 p
Avail: Univ. Microfilms Order No. 77-5067

The mechanisms for the production of fine uniform grain sizes in metal castings by enhancing the growth of the equiaxed zone, by vibrating and/or stirring the melt, and by inducing a large amount of undercooling were considered. Three sets of experiments were done using tin, lead, and other low melting alloys which formed eutectic systems. In one a mold was developed which could be rotated while the molten sample was cooling. Examination of the microstructure of ingots solidified in it allowed the possibility of dendrite breakage and dispersion to be analyzed. In the second series the samples were solidified in a pyrex mold under a liquid cover to isolate them from external sources of nucleation catalysts. In the third series a glass lined copper mold was made to provide the same isolation while permitting more rapid heat transfer. Samples were solidified by melting them in the mold and plunging the mold into a liquid metal bath. Dissert. Abstr.

N77-23235 California Univ., Berkeley.
MARTENSITE TRANSFORMATION AND SHAPE MEMORY EFFECT IN Ni-Ti ALLOY Ph.D. Thesis
Hani Abo El-Fotoh Mohamed 1976 117 p
Avail: Univ. Microfilms Order No. 77-4544

The martensitic transformation and mechanical shape memory effect in a polycrystalline Ti-50.3 at.% Ni alloy were investigated. The mechanism of the memory effect in this particular alloy was explained. The high temperature phase possesses a CsCl-structure (B2 type). During quenching from high temperature excess Ni precipitates in the form of very fine highly coherent ordered particles or clusters prior to the martensitic transformation. The CsCl-structure transforms by inhomogeneous shear in a thermoelastic manner into a two-layer close-packed structure which has a distorted orthorhombic unit cell (martensite). The martensitic phase forms mostly in self-accommodating groups. Each member of a group is internally twinned and members of a group are themselves twin-related along the same plane. Dissert. Abstr.

N77-23236*# Metcut Research Associates, Inc., Cincinnati, Ohio.
TENSILE AND CREEP RUPTURE PROPERTIES OF (16) UNCOATED AND (2) COATED ENGINEERING ALLOYS AT ELEVATED TEMPERATURES
Louis J. Fritz and W. P. Koster 15 Jan. 1977 176 p
(Contract NAS3-18911)
(NASA-CR-135138; Rept-931-21300) Avail: NTIS HC A09/MF A01 CSCL 11F

Sixteen test materials were supplied by NASA-Lewis Research Center as wrought bar or cast remelt stock. The cast remelt stock was cast into test blanks with two such materials being also evaluated after Jocoat coating was applied. Mechanical properties evaluated included tensile, modulus of elasticity, Poisson's Ratio, creep properties and creep rupture strength. Tests were conducted at temperatures applicable to the service temperature of the various alloys. This range extended from room temperature to 1000 C. Author

N77-23237# Royal Aircraft Establishment, Farnborough (England).
FORMING, MICROSTRUCTURE FORMATION AND MECHANICAL PROPERTIES OF TITANIUM ALLOY TiAl6V4
K. Gazioglu, K.-J. Grundhoff, P. Funke, and W. Bunk Sep. 1976 19 p refs Transl. into ENGLISH from a German document
(RAE-Lib-Trans-1901; BR55578) Avail: NTIS HC A02/MF A01

The effects of deformation on the microstructure and mechanical properties of alloy TiAl6V4 were investigated. An ingot divided into four sections was deformed at four different temperatures. Three of the temperatures chosen were below the alpha yields beta transition temperature, i.e. in the alpha + beta field. Two techniques of beta working were used: (1)

forging and (2) extrusion using a high speed ram. The deformation stages were established in such a way that a characteristic homogeneous structure resulted when the specimens were examined metallographically. Homogeneity of the microstructure was achieved after working in the (alpha + beta)-field if the degree of deformation following beta-forging exceeded 60 percent, and if the deformation stages were sufficiently large at ca. 20 percent. The effect of the homogeneous microstructure was clearly demonstrated by the reduction in the scatter of test values.
Author

N77-23238*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VOLATILIZATION OF OXIDES DURING OXIDATION OF SOME SUPERALLOYS AT 1200 C
Isidor Zaplatynsky Washington Apr. 1977 18 p refs
(NASA-TN-D-8462; E-8978) Avail: NTIS HC A02/MF A01 CSCL 11F

Volatilization of oxides during cyclic oxidation of commercial Nichrome, Inconel 750, Rene 41, Stellite 6B, and GE-1541 was studied at 1200 C in static air. Quantitative analysis of oxide vapor deposits revealed that oxides of tungsten, molybdenum, niobium, manganese, and chromium volatilized preferentially from the oxide scales. Aluminum and silicon were not detected in vapor deposits. For all the alloys except GE-1541, chromium was found to be the main metallic element in the oxide scales.
Author

N77-23239*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE APPLICATION OF DIGITAL TECHNIQUES TO THE ANALYSIS OF METALLURGICAL EXPERIMENTS
Thomas J. Rathz Feb. 1977 45 p refs Original contains color illustrations
(NASA-TM-X-73379) Avail: NTIS HC A03/MF A01 CSCL 11F

The application of a specific digital computer system (known as the Image Data Processing System) to the analysis of three NASA-sponsored metallurgical experiments is discussed in some detail. The basic hardware and software components of the Image Data Processing System are presented. Many figures are presented in the discussion of each experimental analysis in an attempt to show the accuracy and speed that the Image Data Processing System affords in analyzing photographic images dealing with metallurgy, and in particular with material processing. Author

N77-23240*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH VELOCITY OXIDATION AND HOT CORROSION RESISTANCE OF SOME ODS ALLOYS
Carl E. Lowell and Daniel L. Deadmore Apr. 1977 19 p refs
(NASA-TM-X-73656; E-9172) Avail: NTIS HC A02/MF A01 CSCL 11F

Several oxide dispersion strengthened (ODS) alloys were tested for cyclic, high velocity, oxidation, and hot corrosion resistance. These results were compared to the resistance of an advanced, NiCrAl coated superalloy. An ODS FeCrAl were identified as having sufficient oxidation and hot corrosion resistance to allow potential use in an aircraft gas turbine without coating.
Author

N77-23241*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OXIDATION AND CORROSION BEHAVIOR OF MODIFIED-COMPOSITION, LOW-CHROMIUM 304 STAINLESS STEEL ALLOYS
Joseph R. Stephens and Charles A. Barrett Washington May 1977 35 p refs
(NASA-TN-D-8459; E-8872) Avail: NTIS HC A03/MF A01 CSCL 11F

The effects of substituting less strategic elements than Cr on the oxidation and corrosion resistance of AISI 304 stainless steel were investigated. Cyclic oxidation resistance was evaluated at 870 C. Corrosion resistance was determined by exposure of specimens to a boiling copper-rich solution of copper sulfate and sulfuric acid. Alloy substitutes for Cr included Al, Mn, Mo, Si, Ti, V, Y, and misch metal. A level of about 12% Cr was the minimum amount of Cr required for adequate oxidation and corrosion resistance in the modified composition 304 stainless steels. This represents a Cr saving of at least 33%. Two alloys containing 12% Cr and 2% Al plus 2% Mo and 12% Cr plus 2.65% Si were identified as most promising for more detailed evaluation.
Author

N77-23242# Carnegie-Mellon Univ., Pittsburgh, Pa.
GENERALIZATION OF INTERNAL CENTRIFUGAL ZONE GROWTH OF METAL-CERAMIC COMPOSITES
Robert F. Sekerka and Robert A. Hartzell Aug. 1976 102 p refs
(Contract E(11-1)-2407)
(COO-2407-4) Avail: NTIS HC A06/MF A01

The electric and temperature fields within inductively heated materials are calculated in order to better understand the essential features of the crystal growth process called Internal Centrifugal Zone Growth. A complicated two-dimensional problem is studied via a simple one-dimensional model which applies to infinitely long samples heated by infinitely long induction coils. Two such one-dimensional models are presented. In the first model, all material properties of the sample are assumed to be independent of temperature. The coupled differential equations determining the electric field and temperature distributions within the sample are solved analytically. Resulting profiles of temperature and electromagnetic fields within the sample provide a basis for more sophisticated models. The second model deals with materials (e.g., oxides) whose electrical conductivities are very low at room temperature but increase significantly with temperature. ERA

N77-23243# European Space Research and Technology Center, Noordwijk (Netherlands).
EXAMINATION OF THE OUTGASSING OF RAYCHEM SOLDER SLEEVES
G. A. F. Premat Paris ESA Feb. 1977 17 p In FRENCH; ENGLISH summary
(ESA-TM-158) Avail: NTIS HC A02/MF A01

Outgassing tests performed on Raychem solder sleeves and the equipment constructed for this purpose are described. The tests are carried out to determine the total weight loss under vacuum and the condensable volatile products, as well as the airtightness of the sleeves.
ESA

N77-23244# National Physical Lab., Teddington (England). Div. of Materials Applications.
EUROPEAN CONCERTED ACTION. COST 50: MATERIALS FOR GAS TURBINES. NPL 8 - INFLUENCE OF METALLURGICAL VARIABLES ON LOW CYCLE FATIGUE BEHAVIOUR OF Ni-Cr BASE ALLOYS AT HIGH TEMPERATURES FINAL REPORT
M. F. Day and G. B. Thomas Oct. 1976 69 p refs
(NPL-DMA-254) Avail: NTIS HC A04/MF A01

Low cycle fatigue test data have been produced for two Ni-Cr base alloys, wrought IN597, and cast IN738LC. The cyclic testing waveforms employed were either strain or load controlled, and tension dwell periods were introduced in some of the tests. Tension dwell periods in both load and strain cycling have produced considerable reductions in cyclic endurances in the wrought IN597 alloy, but these were greater in load cycling. The effect in the cast IN738LC alloy was less in load cycling which was attributed to its greater creep strength. The two alloys have almost identical endurance curves under sawtooth load cycling. Overaging of the IN597 alloys for periods of 5,000 or 10,000 h reduced the endurance in both sawtooth and dwell period load cycling and sawtooth strain cycling but increased it in the case of dwell period strain cycling. Intercrystalline failure was found in both alloys where dwell periods were introduced into load cycling, and in dwell period strain cycling in the IN597 alloy. Examination has revealed grain boundary cavitation in fractured specimens, and the cavity density in the load cycled IN597 specimens was somewhat higher than in monotonic creep specimens. A simple fractional life approach to IN597 alloy test results where the testing cycle contained tension dwell periods, has produced a reasonable fit for both load and strain controlled cycling. In the strain cycling tests and equivalent stress was used for the stress-relaxation periods. The IN738LC alloy test results do not appear to fit the relationship as well.
Author (ESA)

N77-23245# Air Force Academy, Colo.
THE ELECTROLYTIC REMOVAL OF ALUMINUM FROM A TWO-PHASE ALUMINUM-TRIALUMINUM NICKELIDE MATRIX Final Technical Report, Jul. 1975 - Sep. 1976
John C. Nardi, Charles L. Hussey, Lowell A. King, and John K. Erbacher Nov. 1976 39 p refs
(AD-A032084; FJSRL-TR-76-0018) Avail: NTIS HC A03/MF A01 CSCL 07/4

The selective electrolytic removal of aluminum from a two-phase matrix of aluminum containing an aligned microstructure of a eutectic alloy, Al3Ni, has been demonstrated feasible in aluminum chloride containing molten salts. Both the 1:1 molar ratio aluminum chloride-sodium chloride melt at 175 C and the 2:1 aluminum chloride-1-ethylpyridinium bromide melt at 23 C were found suitable for this separation. The anodic decomposition potential of Al3Ni in these melts was estimated using linear sweep voltammetry. An apparatus of novel design was used to provide a continuously flowing electrolyte stream past the matrix sample effecting an efficient removal of aluminum.
Author (GRA)

N77-23246# Army Materials and Mechanics Research Center, Watertown, Mass.
THE 350 MARAGING STEEL PROCESSED BY POWDER METALLURGY Final Report
Saul Isserow Sep. 1976 24 p refs
(DA Proj. 1T1-62105-AH-84)
(AD-A033231; AMMRC-TR-76-29) Avail: NTIS HC A02/MF A01 CSCL 11/6

Rods and tubes of 350 maraging steel were extruded from rotating electrode process powder and from cast-and-wrought bar stock from two sources. Samples from the rods and tubes received various heat treatments and were then subjected to tests of tensile behavior and impact resistance. The results of these tests and metallographic examination are presented and discussed as they are affected by factors such as material source and heat treatment. Consideration is given to scale-up to larger components and to means of achieving higher strength maraging steel.
Author (GRA)

N77-23247# Naval Research Lab., Washington, D. C. Ocean Technology Div.
EFFECTS OF GRAIN SIZE AND TEMPERATURE ON SUB-CRITICAL CRACK GROWTH IN A533 STEEL Interim Report
F. R. Stonesifer Nov. 1976 31 p refs
(NRL Proj. F01-03; RR0230345)
(AD-A033466; NRL-MR-3400) Avail: NTIS HC A03/MF A01 CSCL 11/6

Grain size and temperature affect sub-critical crack growth rate in A533 B steel only to the extent to which they affect K sub Ic and the onset of rapid fracture. The zero growth threshold seems virtually unaffected by either grain size or temperature within the brittle fracture range. As the testing temperature is reduced, the value of K sub Ic approaches the threshold value, eliminating the central portion of the da/dN vs Delta K curve. The observed fatigue crack growth rates then reflect both the variability associated with nearness of Delta K and the high values of da/dN associated with nearness of K sub max to K sub Ic.
GRA

N77-23248# Army Materials and Mechanics Research Center, Watertown, Mass. Materials Application Div.
IMPULSE RESISTANCE SINTERING OF TUNGSTEN Final Report
Jacob Greenspan Sep. 1976 16 p refs
(DA Proj. 1T1-62105-AH-84)
(AD-A033024; AMMRC-TR-76-32) Avail: NTIS HC A02/MF A01 CSCL 13/6

Applicability of impulse resistance sintering to tungsten, and to powder mixes rich in tungsten, was explored in experiments relating process parameters to the sample characteristics. Short consolidation time, fine microstructure, and the ability to handle unusual alloy combinations are some characteristics unique to the method.
GRA

N77-23249# Aluminum Co. of America, Alcoa Center, Pa. Physical Metallurgy Div.
DEVELOPMENT OF AN Al-Mg-Li ALLOY Final Report
T. H. Sanders, Jr. 9 Jun. 1976 154 p refs
(Contract N62269-74-C-0438)
(AD-A034954; Rept-56-76-AH352; NADC-76397-30) Avail: NTIS HC A08/MF A01 CSCL 11/6

A program to optimize composition in the Al-Mg-Li system was conducted in two phases. In Phase I, a series of alloys containing Al-3.5 Mg-2.5 Li with Cr, Mn, or Zr was investigated. The alloy containing 0.3 percent Mn developed the best combination of strength and notch toughness. Under Phase II, effects of Mg and Li content in the Al-Mg-Li-0.3 Mn alloy system were determined. Nine alloy combinations ranging from 1.4 to 3.1 Li and 2.0 to 4.9 Mg were evaluated. Strength and modulus increased and density decreased with increasing Li. Fracture toughness of these alloys were below minimum acceptable levels for commercial product.
Author (GRA)

N77-23250# Army Materials and Mechanics Research Center, Watertown, Mass.
SHOCK ABSORPTION CAPABILITY OF A SINGLE-CRYSTAL BETA-ALUMINUM-BRONZE ROD Final Report
Albert A. Warnas Aug. 1976 16 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A033648; AMMRC-TR-76-24) Avail: NTIS HC A02/MF A01 CSCL 11/6

Slender single-crystal beta-aluminum-bronze rods exhibited large recoverable strains and large hysteresis upon buckling under static and dynamic cyclic loading conditions at room temperature. The cyclically buckled rods dissipated between 25 and 49 percent of the input energy which is comparable to that for cyclically stretched rubber. During buckling only the regions at the bends, about two inches of the rod, were strained, participated in the energy dissipation process, and experienced a reversible martensitic phase change. Both the static and dynamic tests were repeatable and reproducible with a given rod. The rod-end impacts showed no adverse effects on the rod material. After each impact the material reverted to its pre-impact condition. Because the loading cycle was repeatable and since a large amount of input energy was dissipated, the buckling slender single-crystal beta-aluminum-bronze rod shows capability of shock absorber application.
GRA

N77-23251# Denver Research Inst., Colo.
THERMOMECHANICAL PROCESSING OF NICKEL BASE ALLOY AF2-1DA USING SHOCK WAVE DEFORMATION Final Technical Report, 20 Mar. 1974 - 30 Jun. 1975
Robert H. Wittman 30 Jun. 1976 63 p refs
(Contract N62269-74-C-0281)
(AD-A033857; DRI-5110; NADC-76321-30) Avail: NTIS HC A04/MF A01 CSCL 11/6

An investigation was conducted to study the effects of shock wave deformation and heat treatment on the mechanical properties of nickel base superalloy AF2-1DA. Shock wave deformation having a transient volume strain of 23.6 percent was generated by an explosively induced 500 Kbar shock wave. The shock wave deformation was introduced to AF2-1DA plates in the solution treated condition and after various solution treatments and gamma prime heat treatments. Carbide and/or final aging heat treatments were conducted after shock wave deformation processing. For comparison and evaluation of results, AF2-1DA plates from the same lot of material were thermally processed using the standard solution treatment and aging sequences. Tensile, stress-rupture, and low cycle fatigue testing was conducted on shock wave processed and thermally processed samples. In general, the result was to increase the yield strength by up to 15 percent and the tensile strength by 3-5 percent at the 1400 F test temperature for the shock wave processed alloy relative to the thermally processed alloy. This strength increase was accomplished with a 7 percent increase in elongation and 20 percent increase in the reduction of area. Such increases indicate a substantial increase in toughness of the shock wave processed alloy. The increase in toughness of the shock wave processed material was manifested by measured improvements in the stress-rupture life and the low cycle fatigue life.
GRA

N77-23252# Naval Research Lab., Washington, D. C. Engineering Materials Div.

ENHANCEMENT OF FATIGUE CRACK GROWTH AND FRACTURE RESISTANCE IN Ti-6Al-4V AND Ti-6Al-6V-2Sn THROUGH MICROSTRUCTURAL MODIFICATION Final Report

G. R. Yoder, L. A. Cooley, and T. W. Crooker 24 Nov. 1976 24 p refs

(NRL Proj. M01-24; NRL Proj. M01-25; RR0220146)

(AD-A033687; NRL-8049) Avail: NTIS HC A02/MF A01 CSCL 11/6

Significant enhancement of fatigue crack propagation resistance and plan-strain fracture toughness was obtained in commercial-purity Ti-6Al-4V and Ti-6Al-6V-2Sn by microstructural modification. These alloys were studied in 25.4-mm-thick plates with interstitial oxygen contents of 0.20 and 0.17 weight percent, respectively. Heat treatments were chosen to provide widely varied microstructures; they were a mill anneal, a recrystallization anneal, and a beta anneal. The beta anneal was found to be best for improving the crack tolerance properties in question, but it reduced yield strength 9-14 percent from levels associated with the original mill anneal. The recrystallization anneal significantly enhanced plane-strain fracture toughness and marginally improved fatigue crack propagation resistance with negligible loss of yield strength. Author (GRA)

N77-23253# Naval Research Lab., Washington, D. C.

A MICROMECHANISTIC INTERPRETATION OF CYCLIC CRACK-GROWTH BEHAVIOR IN A BETA-ANNEALED Ti-6Al-4V ALLOY Final Report

G. R. Yoder, L. A. Cooley, and T. W. Crooker 24 Nov. 1976 32 p refs

(NRL Proj. M01-24; RR0220146)

(AD-A033874; NRL-8048) Avail: NTIS HC A03/MF A01 CSCL 11/6

The cyclic crack-growth resistance of a Ti-6Al-4V-0.20 w/o O alloy, originally mill annealed, is found to be improved significantly through beta annealing. This improvement is particularly pronounced below a transition point in the crack-growth behavior of the beta-annealed material, which occurs at a stress-intensity range Delta K = 23 MPa.(m to the 1/2 power). Below this point, the exponent in the growth rate law (da/dN = C(Delta K)to the m power) changes from approximately 3.1 (above) to 6.3 (below). Consequently, crack-growth rates da/dN below the transition point are reduced by as much as an order of magnitude below the levels determined for the mill-annealed condition at comparable Delta K levels. This reduction is due to crack bifurcation. GRA

N77-23254# State Univ. of New York, Buffalo. Dept. of Engineering Science, Aerospace Engineering and Nuclear Engineering.

ON THE ANALOGY BETWEEN THERMALLY AND IRRADIATION INDUCED CREEP Summary Report

F. A. Cozzarelli and S. Huang Sep. 1976 38 p refs

(Contract N00014-75-C-0302)

(AD-A034885; Rept-96) Avail: NTIS HC A03/MF A01 CSCL 11/6

Employing an analogy between thermally induced and irradiation induced creep, physical arguments are used first to deduce a one-dimensional constitutive relation for metals under stress in a high temperature and high neutron flux field. This constitutive relation contains modified superposition integrals in which the temperature and flux dependence of the material parameters is included via the use of two reduced time scales; linear elastic, thermal expansion and swelling terms are also included. A systematic development based on thermodynamics, with the stress, temperature increment and defect density increment as independent variables in the Bibbs free energy, is then employed to obtain general three-dimensional memory integrals for strain; the entropy and coupled energy equation are also obtained. Modified superposition integrals similar to those previously obtained by physical argument are then obtained by substituting special functions into the results of the thermodynamic analysis, and the special case of an isotropic stress power law is examined in detail. Author (GRA)

N77-23255# Nuclear Metals, Inc., Concord, Mass.

FILLED BILLET OXIDE DISPERSION STRENGTHENED HOLLOW AIRFOIL EXTRUSIONS Final Report, 1 May 1973 - 31 Jul. 1974

Gerald Friedman Wright-Patterson AFB, Ohio AFML Sep. 1976 93 p

(Contract F33615-73-C-5037; AF Proj. 7351)

(AD-A033215; AFML-TR-74-264) Avail: NTIS HC A05/MF A01 CSCL 13/8

An yttria-strengthened, mechanically attrited nickel-chromium-aluminum powder, HDA 8077, (Ni-16CR-4Al-1.5Y2O3 nominal composition) was extruded with no prior consolidation into tubes and thin-wall hollow airfoils. Through metallography, physical and mechanical property determination, and elevated temperature dynamic oxidation tests, it was determined that strong, corrosion-resistant, net airfoil shapes could be made directly from powder by the filled billet extrusion technique. Process scale-up recommendations for larger airfoils are included. GRA

N77-23256# International Nickel Co., Inc., Suffern, N. Y. Paul D. Merica Research Lab.

OXIDE DISPERSION STRENGTHENED HIGH VOLUME FRACTION GAMMA PRIME Ni-Cr-Al ALLOYS MADE BY MECHANICAL ALLOYING Final Report, May 1975 - Sep. 1976

Le Roy R. Curwick Dec. 1976 81 p refs

(Contract N00019-75-C-0313)

(AD-A034174; Rept-2218-4) Avail: NTIS HC A05/MF A01 CSCL 11/6

An investigation was conducted to determine the feasibility of producing oxide dispersion strengthened high volume fraction gamma prime Ni-Cr-Al alloys by mechanical alloying. The objective of this work was to develop ODS alloys which would derive a significant high temperature strength increment from the retention of high volume fractions (greater than 50 percent) of gamma prime at their intended use temperature of 2000 F. In addition, higher aluminum, beta phase containing alloys were investigated, as well as quaternary additions of Ti and W to a high volume fraction gamma prime base alloy. GRA

N77-23257# Army Electronics Command, Fort Monmouth, N. J.

MANUFACTURING METHODS AND TECHNOLOGY MEASURE FOR MICROWAVE FERRITE POWDERS FOR ARC PLASMA SPRAYING Research and Development Technical Report, Jul. 1973 - Jan. 1976

Richard W. Babbitt and William Wade Oct. 1976 45 p refs

(AD-A034229; ECOM-4446) Avail: NTIS HC A03/MF A01 CSCL 13/8

Commercially available spray-dried lithium powders were selected for the arc plasma fabrication of C-Band and S-Band phase shifters. Several spray-dried powders were evaluated and only those which flowed freely were suitable for the arc plasma spray (APS) process. Selected spray-dried powders were sprayed over a range of arc plasma conditions and the magnetic properties measured to determine the best APS parameters for fabricating phase shifters. The necessary ovens and control equipment were designed and built for spraying phase shifters. Several different dielectric compositions which were to be used as inserts for phase shifters were evaluated. Non-reciprocal, waveguide, ferrite phase shifters were fabricated by arc plasma spraying, and the devices were tested for insertion loss and differential phase shift. Author (GRA)

N77-23258# Rock Island Arsenal, Ill. General Thomas J. Rodman Lab.

HEAT SETTING PROCEDURES FOR HELICAL COILED SPRINGS Final Report, Feb. - Apr. 1976

Henry P. Swieskowski Dec. 1976 43 p ref

(AD-A034591; RIA-R-TR-76-044) Avail: NTIS HC A03/MF A01 CSCL 13/9

Various heat setting procedures for the manufacture of helical compression springs were investigated to determine optimum heat setting methods that will minimize operational spring set and load losses. Production springs were fabricated from music wire, stainless steel, and chrome vanadium materials. The springs were given heat setting treatments under different conditions of temperatures, time durations, and stress levels. Effects of the various heat setting procedures on spring set and load reductions were evaluated by laboratory endurance tests. Recommended heat setting procedures based on study results are given for the

spring materials and test conditions investigated in this project.
Author (GRA)

N77-23259# Rock Island Arsenal, Ill. General Thomas J. Rodman Lab.
THE NUMERICAL SOLUTION OF THE DYNAMIC RESPONSE OF HELICAL SPRINGS Final Report, Nov. 1975 - May 1976
Sunil K. Sinha (Illinois Univ., Urbana) and George A. Costello (Illinois Univ., Urbana) Dec. 1976 55 p refs
(AD-A034588; RIA-R-TR-76-045) Avail: NTIS HC A04/MF A01 CSCL 13/9

An analysis was conducted during the period of November 1975 to May 1976 to determine the dynamic response of helical springs under axial impact with particular application to the return spring in the M60A2 tank recoil mechanism. The study was performed by the University of Illinois at Urbana, Illinois under the direction of the General Thomas J. Rodman Laboratory, Rock Island Arsenal. The dynamic behavior of the impacted spring is described by two coupled nonlinear partial differential equations. Two computer solutions to the equations are obtained by the methods of finite differences and nonlinear characteristics. Results of the two numerical techniques are compared with the closed form solution of the linear equations. The study indicates that frictional binding may occur between the spring coil diameter and the guide components which will result in failure to return to battery. Author (GRA)

N77-23260# National Bureau of Standards, Washington, D. C. Inst. for Materials Research.
THE ROLE OF PASSIVE FILM GROWTH KINETICS AND PROPERTIES IN STRESS CORROSION AND CREVICE CORROSION SUSCEPTIBILITY Technical Summary Report, Oct. 1975 - Nov. 1976
J. Kruger and J. R. Ambrose Nov. 1976 57 p refs
(Contract NAONR-18-69; NR Proj. 036-082)
(AD-A034723; NBSIR-76-1170; TSR-7) Avail: NTIS HC A04/MF A01 CSCL 11/6

This report consists of four parts: (1) a study of the influence of Mo in Fe-Mo alloys on crevice corrosion, finding that approximately 5 percent Mo is needed to affect repassivation in a crevice; (2) the description of a new technique for measuring repassivation rates in a crevice; (3) a description of alloys prepared to simulate the composition of metal near grain boundaries of sensitized austenitic stainless steel, using these alloys for studies of the effect of sensitization on repassivation kinetics; (4) a review of new approaches in the study of localized corrosion.
GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N77-23261 Kentucky Univ., Lexington.
ON ELASTIC MATERIALS WITH STRAIN ENERGIES DEPENDENT ON THE DERIVATIVES OF STRAIN Ph.D. Thesis
James Michael McGlaun 1976 178 p
Avail: Univ. Microfilms Order No. 77-5696

Terms appearing in Hamilton's principle for elastic materials are generalized such that the strain energy density depends on the first material derivatives of the displacement from an arbitrary reference configuration. Using the invariance of the strain energy density to rigid body motions, it is shown that momentum and moment of momentum are conserved. Also reduced forms of the strain energy density are investigated. The results of an investigation of a particular boundary value problem are presented. Sinusoidal tractions are specified on the interior of a circular hole of radius in an infinite medium. Dissert. Abstr.

N77-23262 Clarkson Coll. of Technology, Potsdam, N.Y.
TOXIC GAS EVOLUTION FROM POLYMERS: REACTION KINETICS AND MECHANISMS OF POLYURETHANE DEGRADATION Ph.D. Thesis
Koichi Takada 1976 197 p
Avail: Univ. Microfilms Order No. 77-4338

The kinetic study of the thermal-oxidative degradation of polyurethanes was extensively carried out utilizing various techniques. Toxic gas evolution such as HCN from polyurethanes was investigated. The specific cyanide electrode was employed for monitoring HCN evolution as a function of exposure time, temperature, oxygen concentration of flowing gases, and film thickness of polymers. Gas chromatography was used to determine gases other than HCN. Oxidative degradations were performed in closed systems for this particular investigation. CO2 and CO evolution were mainly discussed. From the polymer structural point of view, the change of molecular-weights and solubility were ascertained. Infrared spectra of the residual polymers were obtained as a function of exposure time and temperature. Purely thermal degradations were performed to contrast it with oxidative degradations. Dissert. Abstr.

N77-23263 North Carolina State Univ., Raleigh.
THE PREPARATION OF REVERSE OSMOSIS MEMBRANES AND THEIR PROPERTIES Ph.D. Thesis
Edison Bittencourt 1976 190 p
Avail: Univ. Microfilms Order No. 76-28460

Ion containing membranes were prepared by Co60, mutual irradiation grafting of 2-vinyl-pyridine (2-VP) and 4-vinyl-pyridine (4-VP) to polyvinyl chloride (PVC) and poly 3, 3 bischloromethyl oxetane polyoxetane, films followed by quaternization with methyl bromide. Grafting was conducted in vacuum and in nitrogen atmosphere with identical yields in both methods. The quaternization of the grafted chains was complete in the case of 2-VP grafted polyoxetane films which were chosen for the reverse osmosis experiments due to the complete removal of homopolymer. Complete quaternizations were obtained with methyl bromide by exposing the grafted films in vacuum-sealed glass ampoules at 60 C. Dissert. Abstr.

N77-23264 Connecticut Univ., Storrs.
MELTING RATES OF POLYMERS UNDER SHEAR CONDITIONS Ph.D. Thesis
Jhy-Dou Robert Lo 1976 231 p
Avail: Univ. Microfilms Order No. 77-4280

Melting models were developed for both crystalline polymers and amorphous polymers under shear conditions. Solid blocks of high-density and low-density polyethylenes and commercial polystyrene were melted on a hot moving surface over a range of surface temperatures and velocities. The experimental melting rates were determined by the vertical traveling velocity of the polymer blocks. To predict the theoretical melting rates, the conservation equations of mass, momentum, and energy were applied to the melting layer, simplified by an order of magnitude analysis, and solved by either the quasilinearization or the integral methods. All models were calculated using FORTRAN IV computer programs. To generalize the melting models, a dimensional analysis was used to characterize the melting system by a minimum number of dimensionless groups. Dissert. Abstr.

N77-23265 California Univ., Berkeley.
THERMODYNAMICS AND RHEOLOGY OF PLASTICIZED BLOCK COPOLYMERS Ph.D. Thesis
Efrain Rafael Pico 1976 268 p
Avail: Univ. Microfilms Order No. 77-4570

Block copolymers were shown to exist in microphase separated states in which different parts of the same molecule belong to different phases. The thermodynamic theory of bulk ABA triblock copolymers was extended to block copolymer-solvent systems. Using the molecular parameters, the composition of the system, and temperature as input information, the theory calculates some of the thermodynamic quantities associated with the change that leads from a homogeneous system to the microphase separated state mentioned above. The calculation of these quantities allows the prediction of the most thermodynamically favored morphology of the phase separation--spherical or cylindrical domains of A (or B) in a matrix of B (or A), or lamellae of A and B. The separation temperature (Ts) at which the microphase separated-to-homogeneous transition occurs is also predicted by the theory. Dissert. Abstr.

N77-23266 Wisconsin Univ., Madison.
ON INVESTIGATION, IMPROVEMENT, AND DESIGN OF STEPS INVOLVED IN METAL PLATING OF NON-CONDUCTORS Ph.D. Thesis
Hamid Moayed Ghorashi 1976 346 p
Avail: Univ. Microfilms Order No. 76-28144

The complex nature and mechanism of activation of formvar film was investigated with particular reference to the part played by the rinse water pH. The effect was investigated by using electron microscopy. The results showed that rinse pH at 9 produced a uniformly activated surface. Effect of mold temperature on etching of a platable grade of polypropylene was also investigated. Scanning electron microscopy and multiple attenuated total reflectance infrared spectroscopy were employed. The results showed a great dependence of etching rate on mold temperature for injection molded polypropylene. The effect of chromic acid etch on adhesion of copper to the polypropylene was also investigated. Dissert. Abstr.

N77-23267*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
FLAME-RESISTANT LIQUID OXYGEN COMPATIBLE NEOPRENE RUBBER COMPOSITION Patent Application
Charles W. Bright, inventor (to NASA) Filed 12 May 1977 15 p
(NASA-Case-KSC-11020-1; US-Patent-Appl-SN-796257) Avail: NTIS HC A02/MF A01 CSCL 11A

A flame-resistant, liquid oxygen compatible neoprene rubber composition for use as a joint sealant on the space shuttle runway was considered. It consists of polychloroprene, magnesium oxide, zinc oxide, carbon black, and aluminum oxide hydrate. It provides a LOX compatible, weathertight, extrudable joint sealant composition which is resistant to jet fuel and fire retardant or fire resistant. NASA

N77-23268# Pennsylvania State Univ., University Park. Dept. of Material Sciences.
CERAMIC RESEARCH ON TRANSFORMATIONAL SUPERPLASTICITY AND STOICHIOMETRY EFFECTS ON FRACTURE Research Progress Report, 1 Jun. 1975 - 31 May 1976
Richard C. Bradt and John C. Hoke 1 Mar. 1976 17 p refs (Contract E(11-1)-3420)
(COO-3420-5) Avail: NTIS HC A02/MF A01

The progress of the program is reviewed by treating each of the areas separately. In the superplasticity investigation, the results of the Bi2WO6 and Bi2MoO3 systems are discussed both in terms of the transformational deformation and also the thermal cycling growth phenomenon. The growth phenomenon on thermal cycling through the phase transition shows some interesting bulk and microstructural features in terms of specimen strain and highly anisotropic grain growth. The stoichiometry effects on the fracture (K/sub Ic/ and K-V behavior) of TiO/sub 2-x/ and Fe/sub 1-x/ are reviewed as that study has been completed. Progress on the MgO X Al2O3 system is discussed. ERA

N77-23269# Royal Aircraft Establishment, Farnborough (England).
MECHANICAL SHEAR DEGRADATION OF POLYMERS IN SOLUTION. A REVIEW
J. Knight 12 Jun. 1976 34 p refs
(RAE-TR-76073; BR53365) Avail: NTIS HC A03/MF A01

The characteristics of different degrading devices are mentioned together with the factors which determine the rate and extent of breakdown. The energetics and possible mechanisms of degradation are discussed. A more critical overall view is given of the results in order to list the conclusions which can be supported by the majority of evidence. Author (ESA)

N77-23270# Army Materials and Mechanics Research Center, Watertown, Mass. Polymer and Chemistry Div.
MACROMOLECULAR CHARACTERIZATION OF POLY(BIS (M-CHLOROPHENOXY)-PHOSPHAZENE) Final Report
Gary L. Hagnauer, Bernard R. LaLiberte, Robert E. Singler, Susan J. Kalian, and Elizabeth R. Plumer Aug. 1976 33 p refs
(DA Proj. 1T1-61102-AH-42)
(AD-A032039; AMMRC-TR-76-25) Avail: NTIS HC A03/MF A01 CSCL 07/4

The macromolecular structures and structure-property relationships of five poly(bis(m-chlorophenoxy)phosphazene) samples are critically analyzed. The polymers are found to have high molecular weights and broad, bimodal molecular weight distributions. Differences are observed in polymer chain structure (branching) and solubility characteristics. An intrinsic viscosity-molecular weight relationship is established for the linear polymer in chloroform solution at 25 C. The rate and mechanism for the thermal degradation in air of the polyphosphazenes are investigated and compared with that of polystyrene. Mechanical properties, thermal transitions, and thermal stability are markedly influenced by differences in the macromolecular and chemical structures of the polymers. GRA

N77-23271# Queen Mary Coll., London (England).
FRACTURE MECHANICS OF INELASTIC POLYMERS Annual Report, Jun. 1975 - Jun. 1976
E. H. Andrews, L. B. Ramirex DeMolina, Y. Fukahori, and S. Barnes Jun. 1976 32 p refs
(Grant DA-ERO-75-G-049; DA Proj. 1T1-61102-B-32D)
(AD-A032044) Avail: NTIS HC A03/MF A01 CSCL 07/4

The fracture of various elastomeric materials (SBR and EPLM rubbers) is considered in the light of Andrews' theory of generalized fracture mechanics. The equation is used to predict values for comparison with experimental determinations, and good agreement is reported. The fracture energy for a center crack or SEN specimen is given for a non-linear inelastic solid. Preliminary work is reported on the theoretical prediction of fracture energies in a ductile plastic polycarbonate. GRA

N77-23272# Army Natick Research and Development Command, Mass.
RESPONSE OF POLYMERS TO TENSILE IMPACT. 3. THE INTEGRAL-EQUATION, SUCCESIVE-SUBSTITUTION METHOD APPLIED TO NON-LINEAR MATERIALS HAVING TIME-DEPENDENCE (CREEP, RELAXATION)
Prescott D. Crout, Malcolm N. Pilsworth, Jr., and Harold J. Hodge Oct. 1976 64 p refs
(AD-A031396; NARADCOM-TR-76-36-FSL) Avail: NTIS HC A04/MF A01 CSCL 11/5

A better understanding is required of tensile-impact strains in military components such as body armor and parachute straps. A solution for the propagation of strain waves in elastic materials was extended to materials exhibiting creep and relaxation. The basic integral-equation, successive-substitution solution developed in two previous reports was extended using a model with two springs in series and a dashpot parallel to one of them. With appropriate values, the model conformed adequately to experimental tensile-impact data on a 50 cm length of Nylon yarn. For this short specimen, wave reflections confused the experimental data and there was a lack of uniqueness in the computed results. Different choices of model parameters represented the data equally well. Hence impact experiments were made on 400 cm specimens of Nylon yarn in which reflections would not be observed. These experiments could not be represented with the model. The experimental data showed that the Nylon contracted after the initial strain pulse had elongated it. Four percent strains fell to 3 percent during a single experiment. Contraction of the material had not been expected and deserves further investigation. Methods of choosing the parameters of the model are presented in an appendix. Author (GRA)

N77-23273# Naval Weapons Center, China Lake, Calif.
VOID FILLER FOAM ACCELERATED LOAD TESTING Final Report, Jul. 1973 - Jun. 1974
W. T. Burt Nov. 1976 45 p refs
(AD-A034118; JTCG/AS-74-T-011) Avail: NTIS HC A03/MF A01 CSCL 13/4

This report presents the Phase IV program to qualify void filler foam for use in military aircraft. Phases I, II, and III of this task also are summarized in this report to show the evolution of the void filler foam concept. The purpose of the foam installation around the aircraft fuel cell is to reduce projectile damage and fuel fire hazard, and to improve thermal protection and aircraft survivability. The accelerated load testing was conducted to determine the ability of void filler foam to withstand the loads encountered during aircraft carrier deck operations.

Results of the program show the void filler foam, used as a replacement for the backingboard on an A-4 aircraft, can withstand the loads associated with catapult launch and arrested landings. GRA

N77-23274# Aeronautical Research Labs., Melbourne (Australia).
ADHESIVE STRENGTH TESTS OF BONDED DISSIMILAR MATERIALS USING A STEP-LAP SANDWICH SWITCH SPECIMEN
M. J. Davis and A. A. Baker Feb. 1976 20 p refs
(PB-263224/8; ARL/Mat-Note-113) Avail: NTIS HC A02/MF A01 CSCL 11A

A type of specimen was developed to measure the shear strength of adhesive bonds between dissimilar materials. It was used to determine the shear strengths of several adhesive/adherend combinations, and to make a preliminary study of the effects of surface preparation on bond strength, as a guide to selection of adhesive systems of bonding high performance composities to aircraft components. An earlier theoretical analysis of the shear stress distribution in the adhesive layers was used to evaluate maximum shear stress at failure. Reasonably consistent values of this parameter were obtained for a range of geometrical and material configurations. GRA

N77-23275# Plastics Technical Evaluation Center, Dover, N. J.
COMPARISON OF UNITED STATES AND BRITISH METHODS FOR TESTING PLASTIC MATERIALS
Arthur H. Landrock Sep. 1976 129 p refs
(AD-A034734; PLASTEC-N32) Avail: NTIS HC A07/MF A01 CSCL 11/9

This report is a comparison of United States test methods, primarily American Society for Testing and Materials (ASTM) methods with British Standards, for testing plastics materials. A total of 265 test methods are discussed covering the following major subject areas: mechanical properties, effects of temperature, miscellaneous, electrical tests, optical properties, and chemical tests. The objective of the study, which was carried out in cooperation with a Quadripartite Nations project, was to identify comparable U.S. and British Specifications. The report covers standardization methods issued through 1975. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N77-23276# Naval Weapons Support Center, Crane, Ind.
NEW POTENTIALS IN RED PHOSPHORUS COMPOSITIONS Final Report, 1 Jul. 1975 - 1 Jun. 1976
Henry A. Webster, III and Duane M. Johnson 1 Aug. 1976 21 p refs
(AD-A031628; NWSC/CR/RDTR-22) Avail: NTIS HC A02/MF A01 CSCL 19/1

New phosphorus compositions have been demonstrated which meet the current burning rate and smoke volume requirements but do not contain pyrolusite and/or magnesium. Phosphorus composition which used chlorotrifluoroethylene as an oxidizer-binder combination and magnesium as a fuel had reciprocal burning rates of 42-73 s/in. Phosphorus compositions which used calcium sulfate as the oxidizer and boron as the fuel had reciprocal burning rates of 80-130 s/in. These compositions have the advantages of (1) containing no pyrolusite, a foreign-supplied material, and (2) containing no magnesium. The elimination of magnesium reduces the possibility of hydrogen generation in sealed units when subjected to high temperature storage. Recommendations for further work are given. GRA

N77-23277# Naval Ship Research and Development Center, Annapolis, Md. Materials Dept.
AN EVALUATION OF METHANOL, ETHANOL, THE PROPANOLS, AND THE BUTANOLS AS SHIP PROPULSION FUELS
Donald O. Newton Sep. 1976 14 p refs
(AD-A033483; MAT-75-20) Avail: NTIS HC A02/MF A01 CSCL 13/10

This report evaluates the alkyl monohydric alcohols from methanol through the butanols (C-1 to C-4) as Navy ship propulsion fuels. Properties of the alcohols from the technical literature are compared with the properties of Navy ship propulsion hydrocarbon fuels (Diesel Fuel Marine and JP-5). None of these alcohols is suitable as a direct substitute or as an extender for the currently used ship propulsion fuels. The use of methanol with its low volumetric energy content would entail over a 50 percent reduction in range between refuelings; the use of the other alcohols would result in roughly 25 percent to 40 percent loss of range. All the C-1 to C-4 alcohols have flash points below the 60 C minimum considered safe for shipboard fuels. Also, all have low cetane numbers, high water solubility, and problems with toxicity. However, methanol and mixtures of low-boiling alcohols are potentially usable as fuels for new ships specifically designed for their use. GRA

N77-23278# Rocketdyne, McGregor, Tex.
PROJECT DAME: FLIGHT AND SIMULATION TESTING OF A MODIFIED BOMB DUMMY UNIT Final Report, Sep. 1972 - Jun. 1976
J. D. Burton Edwards AFB, Calif. AFRPL Oct. 1976 181 p (Contract F04611-72-C-0049)
(AD-A033299; AFRPL-TR-76-60) Avail: NTIS HC A09/MF A01 CSCL 21/8

Results of a program to determine thermal and vibrational environments imposed on an air-launched propulsion system during captive carriage on high-performance aircraft are presented. Fabrication, instrumentation, ground and flight testing, and analysis of the bomb dummy unit used in the tests and implications, from data obtained, for motor qualification testing of tactical missiles are discussed. The 20 flight tests and three series of ground simulation tests to which the bomb dummy unit was subjected are described, and data obtained from each are presented. Author (GRA)

N77-23279# United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.
DEVELOPMENT AND EVALUATION OF ROTATING VALVE COMBUSTION RESPONSE TEST TECHNIQUE Final Report, 1 Jul. 1974 - 30 Jun. 1976
R. S. Brown Oct. 1976 53 p refs
(Contract F04611-74-C-0045; AF Proj. 5730)
(AD-A033395; CSD-2523-FR; AFRPL-TR-76-72) Avail: NTIS HC A04/MF A01 CSCL 21/9

Studies have been conducted to extend the frequency and pressure range of the rotating valve method for measuring the pressure coupled combustion response of solid propellants. Tests were conducted to evaluate the combustion response of ANB-3066 and UTP-17,075 at pressures of 500, 1,000, and 1,500 psi. The frequency covered the range from 85 to 800 Hz. Frequency and combustion pressure both affect the combustion response, the effect depending on the propellant formulation. Additional tests with UTP-18,586 and Shuttle SRM propellant also showed additional formulation effects on the response. In all cases, the response function extrapolates to the burning rate pressure exponent as predicted by linear combustion theory. A series of tests was also conducted with ANB-3066 from the T-burner master batch. The results were identical to the results obtained on the first program, provided the tests were conducted with samples freshly cut from the cartons. When the samples were potted into motor cases and stored for two years, however, the measured combustion response changed significantly. GRA

N77-23280# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
AUDIBLE AND ULTRASONIC ACOUSTIC EMISSIONS FROM COMPOSITE SOLID PROPELLANTS Interim Scientific Report, Jul. 1975 - Sep. 1976
William A. Bell, James I. Craig, and Warren C. Strahle Sep. 1976 37 p refs
(Grant AF-AFOSR-2805-75; AF Proj. 9711)
(AD-A032875; AFOSR-76-1193TR) Avail: NTIS HC A03/MF A01 CSCL 20/1

Audible and ultrasonic acoustic waves are generated during

deflagration of composite solid propellants. The audible waves can be sensed by microphones while special high frequency pressure transducers are required to measure the ultrasonic signals. These acoustic emissions have a potential use both as diagnostics of the combustion and as a means for the study of fundamental burning processes. To date a family of composite HTPB-AP propellants have been tested. Results which show the effects of pressure level, atmosphere in which burned, AP particle size, aluminum addition, and aluminum coating are presented and discussed. Author (GRA)

N77-23281# Atlantic Research Corp., Alexandria, Va.
EROSIVE BURNING OF COMPOSITE PROPELLANTS Interim Report
Merrill K. King Nov. 1976 32 p refs
(Contract F44620-76-C-0023)
(AD-A033975; AFOSR-76-1251TR) Avail: NTIS HC A03/MF A01 CSCL 21/9

Increasing use of solid rocket motors with low port-to-throat area ratios, including the ultimate case of nozzleless motors, is leading to increased occurrence and severity of burning rate augmentation due to flow of propellant products across burning propellant surfaces (erosive burning). A review of the literature regarding this phenomenon indicates a lack of systematic data defining the effects of propellant's formulation variables on the sensitivity of burning rate to crossflow velocity and the absence of a realistic predictive model for composite propellant burning rate-pressure-velocity relationships. In this paper, a physically realistic picture of the effect of crossflow velocity on composite propellant combustion is presented and a relatively simple analytical model based upon this picture is developed for prediction of composite propellant burning rate as a function of pressure and crossflow velocity, given only the burning rate-pressure relationship in the absence of cross-flow. In addition, hardware developed for testing erosive burning effects at cross flow Mach numbers up to 1.0 is described and a planned systematic test matrix is defined. Preliminary test results are included and compared with predictions made using the aforementioned analytical model. Author (GRA)

N77-23282# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
EROSIVE BURNING STUDIES OF COMPOSITE SOLID PROPELLANTS BY THE REACTING TURBULENT BOUNDARY-LAYER APPROACH Interim Report, 1 Aug. 1975 - 30 Sep. 1976
Nohan K. Razdan and Kenneth K. Kuo Nov. 1976 83 p refs
(Grant AF-AFOSR-2914-76; AF Proj. 9711)
(AD-A033723; AFOSR-76-1424TR) Avail: NTIS HC A05/MF A01 CSCL 21/9

The overall objective of the current research is to achieve a basic understanding of the erosive burning mechanism in solid-propellant rocket motors. Both theoretical and experimental studies are undertaken. In the theoretical modeling, a reactive turbulent boundary-layer approach is used to analyze the erosive burning phenomenon. A second-order turbulent closure has been selected in the theoretical formulation. The theoretical model can be used to study the effect of gas velocity, pressure, streamwise pressure gradient, oxidizer particle size, and oxidizer-to-fuel ratio. For model validation, a test rig has been designed to establish a two-dimensional, turbulent boundary layer flow over a flat plate. The test rig can operate under various gas-dynamic conditions. A laser-photodiode servomechanism has been developed to measure the burning rate, and preliminary tests have demonstrated successful operation of the apparatus. Author (GRA)

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N77-23283# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
NON LINEAR CALCULATION OF SUPERCAVITATING HYDROFOILS NEAR A FREE SURFACE Final Report
A. J. Acosta and D. Furuya Jun. 1976 55 p refs
(Contracts N00014-67-A-0094-0031; N00014-75-C-0430; SR0230101)
(AD-A032789; ENG-193-1) Avail: NTIS HC A04/MF A01 CSCL 13/10

This report summarizes briefly the research carried out under the Contracts N00014-67-A-0031 and N00014-75-C-0430 on the calculation of supercavitating hydrofoils near a free surface. This work appears in six previous publications. The present report concludes this series of publications with a user's list of instructions for the calculation of supercavitating hydrofoils of finite aspect ratio near gravity-free surface. Author (GRA)

N77-23284# Naval Civil Engineering Lab., Port Hueneme, Calif.
CRITERIA FOR GROUNDING CONDUCTIVE FLOORS IN NAVAL HOSPITALS AND ORDNANCE FACILITIES Final Report, Jul. 1974 - Sep. 1975
James L. Brooks and Barry C. Streets Oct. 1976 44 p refs
(AD-A033665; CEL-TN-1458) Avail: NTIS HC A03/MF A01 CSCL 13/3

An investigation of the criteria for grounding conductive floors in Naval hospitals and ordnance facilities has been completed. First, current publications concerned with conductive floor installations were reviewed. Then manufacturers of conductive flooring materials were contacted for the latest technical information available on grounding systems for conductive floors. Finally, a survey was made of existing grounding systems at selected Naval hospitals and ordnance facilities. From this information, design and installation criteria, acceptance testing procedures, and maintenance requirements for conductive flooring installations were developed. Author (GRA)

N77-23285# Hydronautics, Inc., Laurel, Md.
LIFT AND DRAG EFFECTS DUE TO POLYMER INJECTIONS ON THE SURFACE OF SYMMETRIC HYDROFOILS
Abbas M. Sinnarwalla and T. R. Sundaram Oct. 1976 52 p refs
(Contract N00014-71-C-0063; NR Proj. 062-325)
(AD-A034210; TR-7603-1) Avail: NTIS HC A04/MF A01 CSCL 13/10

Experimental results are presented for the effects on the lift and drag on symmetrical hydrofoils due to the injection of dilute polymer solutions on to their surfaces. Results are presented for three different polymers, namely, Polyox, Polyacrylamide and Jaguar; for purposes of comparison, results are also presented for water injection. The results indicate that while, in general, polymer injection leads to a reduction in drag, the lift can either increase or decrease depending on the polymer, the angle of attack, the surface on which the injection is made, the chordwise location at which injection is made and the injection velocity. Results for the effects of the injections on the pressure distributions on the hydrofoil are also presented, and these results are consistent with the force measurements. Tests on the effects of simultaneous injections from several chordwise locations indicate that significant reductions in drag can be achieved by a judicious choice of the locations. GRA

N77-23286# National Bureau of Standards, Washington, D. C.
WHAT ABOUT METRIC Consumer Information Series
Oct. 1976 18 p Supersedes COM-74-11570
(PB-263274/3; NBS-CIS-7-Rev-1976; COM-74-11570) Avail: NTIS HC A02/MF A01 CSCL 14B

The metric system is presented and compared with measurement systems used in the United States. The impact of conversion to metrication is discussed. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N77-23287 British Broadcasting Corp., Kingswood (England). Engineering Div.

SATELLITE BROADCASTING: SLANT PATH ATTENUATION THROUGH RAIN STORMS
J. L. Eaton Feb. 1977 8 p refs
(BBC-RD-1977/7) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A recently proposed statistical precipitation rate profile for isolated rain storms in the U.K. is employed to obtain the effective attenuation path length or effective distance for storms lying directly in the transmission path from a broadcasting satellite operating in the 12 GHz band. This effective slant path distance is a function of the elevation angle and distance from the storm center. The greatest precipitation rate occurs at the center of the storm. The attenuation rate (dB/km) corresponding to uniform rainfall at this maximal precipitation rate, when multiplied by the effective distance, yields the excess path attenuation due to the storm. The results represent the greatest attenuation to be expected in 85 percent of all rain storms. Author

N77-23288 California Univ., Berkeley.
NUMERICAL COMPUTATION OF ELECTROMAGNETIC SCATTERING BY INHOMOGENEOUS DIELECTRIC BODIES OF REVOLUTION Ph.D. Thesis
Michael Allen Morgan 1976 210 p
Avail: Univ. Microfilms Order No. 77-4547

The numerical solution of time-harmonic electromagnetic scattering by rotationally-symmetric penetrable bodies having arbitrary cross sectional profiles, and even continuously inhomogeneous consistency is investigated. A coupled dual scalar potential representation of Maxwell's equations that is valid in generally lossy isotropic inhomogeneous rotationally-symmetric media, and which manifests itself in both a coupled partial differential equation system and an extremely useful variational criterion was developed. Using an optimized variational finite-element approach, and the powerful unimoment method, a very versatile numerical code is described. Dissert. Abstr.

N77-23289*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PERFORMANCE OF BINARY FSK DATA TRANSMISSION SYSTEMS
B. H. Batson 24 Jul. 1973 22 p refs
(NASA-TM-X-74689; JSC-08097) Avail: NTIS HC A02/MF A01 CSCL 17B

Matched-filter detection of binary signals is discussed in terms of the probability of bit error. The equations for the probability of error are derived for coherent phase shift keying, and coherent frequency shift keying (FSK). Suboptimum detection of FSK signals is also discussed for discriminators. F.O.S.

N77-23290*# Axiomatix, Marina del Rey, Calif.
INTEGRATED SOURCE AND CHANNEL ENCODED DIGITAL COMMUNICATION SYSTEM DESIGN STUDY Final Report
Sergei Udalov and Gaylord K. Huth 13 Apr. 1977 120 p refs
(Contract NAS9-13467)
(NASA-CR-151344; R77-04-1) Avail: NTIS HC A06/MF A01 CSCL 17B

The analysis of the forward link signal structure for the shuttle orbiter Ku-band communication system was carried out, based on the assumptions of a 3.03 Mcps PN code. It is shown that acquisition requirements for the forward link can be met at the acquisition threshold C/NO sub 0 value of about 60 dB-Hz, which corresponds to a bit error rate (BER) of about 0.001. It is also shown that the tracking threshold for the forward link is at about 57 dB-Hz. The analysis of the bent pipe concept for the orbiter was carried out, along with the comparative analysis of the empirical data. The complexity of the analytical approach warrants further investigation to reconcile the empirical and theoretical results. Techniques for incorporating a text and graphics capability into the forward link data stream are considered and a baseline configuration is described. Author

N77-23291*# Texas A&M Univ., College Station. Remote Sensing Center.
DEFINITION AND FABRICATION OF AN AIRBORNE SCATTEROMETER RADAR SIGNAL PROCESSOR Final Report
Dec. 1976 60 p refs
(Contract NAS9-14493)
(NASA-CR-151345; PR-3182-3) Avail: NTIS HC A04/MF A01 CSCL 17I

A hardware/software system which incorporates a microprocessor design and software for the calculation of normalized radar cross section in real time was developed. Interface is provided to decommutate the NASA ADAS data stream for aircraft parameters used in processing and to provide output in the form of strip chart and pcm compatible data recording. Author

N77-23292*# LinCom Corp., Pasadena, Calif.
KU-BAND SIGNAL DESIGN STUDY Final Report
W. L. Lindsey and K. T. Woo Mar. 1977 75 p refs
(Contract NAS9-14846)
(NASA-CR-151348; TR-04-7604-6) Avail: NTIS HC A04/MF A01 CSCL 17B

The acquisition/tracking performance of a practical squaring loop in which the times two multiplier is mechanized as a limiter/multiplier combination is evaluated. This squaring approach serves to produce the absolute value of the arriving signal as opposed to the perfect square law action which is required in order to render acquisition and tracking performance equivalent to that of a Costas loop. The Ku-Band orbiter signal design for the forward link is assessed. Acquisition time results and acquisition and tracking thresholds are summarized. A tradeoff study which pertains to bit synchronization techniques for the high rate Ku-Band channel is included and an optimum selection is made based upon the appropriate design constraints. Author

N77-23293*# Hughes Aircraft Co., Culver City, Calif. Radar Systems Group.
SHUTTLE IMAGING RADAR (SIR) CALIBRATION STUDY Final Report
Nov. 1976 108 p refs
(Contract NAS9-14273)
(NASA-CR-151336; P76-448; HAC-Ref-D2617) Avail: NTIS HC A06/MF A01 CSCL 17I

A radar calibration subsystem for measuring the radar backscattering characteristics of an imaged terrain is described. To achieve the required accuracy for the backscattering coefficient measurement (about 2 dB with 80 percent confidence), the space hardware design includes a means of monitoring the state parameters of the radar. For example, the transmitter output power is sampled and a replica of its output waveform is circulated through the receiver. These are recorded digitally and are used on the ground to determine such radar parameters as the transmitter power and the receiver gain. This part of the data is needed by the ground processor to measure the terrain backscattering characteristics. Author

N77-23294# Communications Research Centre, Ottawa (Ontario). Space Applications Branch.
EARLY OPERATIONAL EXPERIENCE WITH A NEW TDMA SYNCHRONIZATION SYSTEM THROUGH CTS
K. E. Brown and P. P. Nuspl Oct. 1976 20 p refs
(CRC-TN-682) Avail: NTIS HC A02/MF A01

A unique TDMA concept is described. The implementation of the concept as an experimental package on the Communications Techology Satellite is briefly discussed. Early operational experience at IF and RF is presented. Centralized synchronization and ranging is demonstrated as feasible. Author

N77-23295*# Comsat Labs., Clarksburg, Md.
PRECIPITATION-ATTENUATION STUDIES BASED ON MEASUREMENTS OF ATS-6 20/30-GHz BEACON SIGNALS AT CLARKSBURG, MARYLAND Final Report, May 1974 - Dec. 1975
D. J. Fang and J. M. Harris Aug. 1976 97 p refs
(Contract NAS5-20740)
(NASA-CR-152501; CLP-74-110) Avail: NTIS HC A05/MF A01 CSCL 20N

Radiometric sky temperature and minute precipitation measurements were intended to broaden the data base required to advance the understanding of the propagation characteristics of the earth-satellite path at frequencies over 10 GHz. Analyses of the data collected from the measurement program have established a detailed correlation between the satellite signal and the signals from auxiliary ground-based measurements. The

indirectly derived statistics agreed reasonably well (or can be reconciled) with the earlier published results. The correlations may therefore be used for indirectly estimating long term cumulative attenuation statistics in the absence of direct satellite signal measurements. Author

N77-23296# European Space Agency, Paris (France).
SATELLITE BROADCASTING
C. Rosetti, ed. and T. D. Guyenne, ed. Feb. 1977 198 p refs Partly in ENGLISH and partly in FRENCH Proc. of an ESA Tech. Symp. held in Stockholm, 22-24 Nov. 1976
(ESA-SP-122) Avail: NTIS HC A09/MF A01

The following topics are covered: regional and domestic systems (Scandinavia, Iran, Canada); possibility of using ESA's Ariane launch vehicle; spacecraft design aspects; point-to-multipoint communication; high-power communication satellite; advanced techniques for 12 GHz TV receivers; 14/11 GHz equipment; receiving station and ground equipment; video-sound transmission; attitude and orbit control of satellites; multi-kW power-supply systems; payload mass increase; and mechanisms. A panel discussion is devoted to the problem of satellite technology applications in developing countries. For individual titles, see N77-23297 through N77-23321.

N77-23297# Department of Communications, Ottawa (Ontario).
PLANNING FOR THE INTRODUCTION OF HIGH-POWER SATELLITES FOR THE DISTRIBUTION OF TELEVISION AND SOCIAL SERVICES IN CANADA
A. Casey-Stahmer and J. Palmer *In* ESA Satellite Broadcasting Feb. 1977 p 7-16 refs (For primary document see N77-23296 14-32)
Avail: NTIS HC A09/MF A01

Planning and experimental work in the high power broadcasting field is outlined, and possible operational applications in Canada in the fields of broadcasting services and social and development services requiring interaction systems are considered. ESA

N77-23298# Tehran Univ. (Iran). Faculty of Science and Technology.
TECHNICAL ASPECTS OF THE IRANIAN DOMESTIC COMMUNICATION SATELLITE
H. Khakzar *In* ESA Satellite Broadcasting Feb. 1977 p 17-22 refs (For primary document see N77-23296 14-32)
Avail: NTIS HC A09/MF A01

A short survey is presented, and the number of transponders for telephony and television broadcasting, their frequencies, and power are suggested. As a result a satellite with 8 to 10 telephony transponders each 6 to 13 W is the 4/6 GHz range and 3 television transponders each 80 to 120 W in 12/14 GHz range seems to be an acceptable solution for the Iranian communication satellite system till 1990. Author (ESA)

N77-23299# European Space Agency, Paris (France). Ariane Dept.
THE EUROPEAN ARIANE LAUNCH VEHICLE [LE LANCEUR EUROPEEN ARIANE]
A. Bellot *In its* Satellite Broadcasting Feb. 1977 p 23-28 In FRENCH (For primary document see N77-23296 14-32)
Avail: NTIS HC A09/MF A01

The European program for the Ariane launch vehicle is presented. Its geostationary performance will be equivalent to that of the Atlas Centaur. The launcher and its performance for development flights (1979-1980) are described. The organization and the present step of development are outlined. A forecast is made of the operational phase starting end 1980 - beginning of 1981. A first estimation of operational launch costs is made. ESA

N77-23300# European Space Research and Technology Center, Noordwijk (Netherlands).
THE ARIANE LARGE SATELLITE AND ITS COMMUNICATIONS MISSIONS **c32**
B. L. Herdan and G. Berretta *In* ESA Satellite Broadcasting Feb. 1977 p 29-34 (For primary document see N77-23296 14-15)
Avail: NTIS HC A09/MF A01

The context and main objectives of the program are described, together with the experimental communications mission analyses which have been performed; the resulting mission definition is outlined. The corresponding payload design is described, and other proposed payload elements are noted. The overall satellite design approach and main characteristics are discussed and a summary of program implementation planning is given. Author (ESA)

N77-23301# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiques et Spatiaux.
PHEBUS: A MULTIPURPOSE SATELLITE [PHEBUS: UN SATELLITE POLYVALENT]
F. Turck *In* ESA Satellite Broadcasting Feb. 1977 p 35-40 In FRENCH; ENGLISH summary (For primary document see N77-23296 14-32)
Avail: NTIS HC A09/MF A01

The design of this multipurpose spacecraft, to be developed by Europe for geosynchronous missions in the Ariane capability, adheres to three guidelines: modularity of the spacecraft architecture, flexibility of the bus subsystem, and evolvability of the technologies employed. While the approach is cost optimized, advanced options are currently usable if required and the adaption to specific missions is then offered in a wide range of requirements. Author (ESA)

N77-23302# Engins Matra, Velizy (France). Space Div.
MODERN ANTENNA CONCEPT FOR DIRECT TV SATELLITES APPLICATION TO NORDSAT
E. Golden *In* ESA Satellite Broadcasting Feb. 1977 p 41-56 (For primary document see N77-23296 14-32)
Avail: NTIS HC A09/MF A01

The European direct TV (DTV) coverage problem is explained and the corresponding requirements of a European DTV satellite are defined. The ideal antenna of this satellite is specified. As an example, Nordsat requirements are summarized, and the new antenna concept which fulfills these requirements is described. The main feature of this antenna is the possibility of generating simultaneously several independent overlapping shaped beams. The same feed horn is used for different beams by connecting one output multiplexer per horn. The improved antenna efficiency and flexibility versus a classical optimized elliptical antenna is shown and the other advantages of the new antenna concept are indicated. An example of a Nordsat payload including the new antenna concept is described. Author (ESA)

N77-23303# Engins Matra, Velizy (France). Space Div.
AN ARIANE SATELLITE CONCEPT FOR TV BROADCASTING APPLICATION TO NORDSAT
C. Goumy *In* ESA Satellite Broadcasting Feb. 1977 p 57-65 (For primary document see N77-23296 14-32)
Avail: NTIS HC A09/MF A01

A satellite platform concept to be launched about mid 1981 by an Ariane launch vehicle and carrying an early Nordsat DTV (direct TV) payload is described. The design criteria for satellite definition are essentially low cost, minimum development risk, and growth potential for following more powerful DTV missions. Author (ESA)

N77-23304# European Broadcasting Union, Brussels (Belgium). Technical Centre.
THE E.B.U. OBJECTIVES FOR SATELLITE BROADCASTING
A. Brown *In* ESA Satellite Broadcasting Feb. 1977 p 67-69 (For primary document see N77-23296 14-32)
Avail: NTIS HC A09/MF A01

The basic objectives for satellite broadcasting, which are to provide for national coverage, low-cost receivers, good technical quality, and the maximum number of programs are outlined. Account must be taken of sound-only broadcasts. The implications of these objectives are considered. For example, national coverage in Europe implies the need for very accurate pointing of the transmitting antenna. The problem of dealing with sound-only broadcasts is not yet completely resolved. The RF bandwidths and protection ratios should be based on the need to transmit existing television standards, but this need not preclude the later development of new systems. Author (ESA)

N77-23305# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.

SPACECRAFT DESIGN ASPECTS FOR ADVANCED COMMUNICATION SATELLITES

D. E. Koelle, H. Kellermeier, and K. Fetzer *In* ESA Satellite Broadcasting Feb. 1977 p 75-84 refs (For primary document see N77-23296 14-32)

Avail: NTIS HC A09/MF A01

The characteristics of a future fourth generation of communication satellites for the period 1982 to 1990 are defined, based on present development trends, technology under development, and foreseeable future system requirements, especially for direct TV broadcasting. The main goal is to further decrease the specific cost of satellite communications, expressed in cost per channel per year. This means longer lifetime, more payload, higher mission flexibility and reliability, and more performance.

Author (ESA)

N77-23306# TRW Defense and Space Systems Group, Redondo Beach, Calif.

AN ADVANCED 30/42 GHz POINT-TO-MULTIPOINT SATELLITE COMMUNICATION SYSTEM

D. Jarett *In* ESA Satellite Broadcasting Feb. 1977 p 85-89 (For primary document see N77-23296 14-32)

Avail: NTIS HC A09/MF A01

An advanced 30/42 GHz television community broadcasting satellite system featuring a spacecraft-switched time division multiple access (SSTDMA) point-to-multipoint communications system is described. Contiguous coverage of the Nordic nations area is obtained using nine 0.4 deg closely packed spot beams. Beam-to-beam isolation of more than 20 dB is provided. Individual 200 watt transmitters are used in each of the nine beams. A capacity of 90 digital television programs (ten per beam) is provided. Frequency reuse, flexibility in channel assignment, simplified satellite channelization, and a high degree of onboard control are provided. In addition, point-to-point telecommunications capability is provided by four 30/18 GHz SSTDMA up/downlinks. Author (ESA)

N77-23307# AEG-Telefunken, Backnang (West Germany).

A HIGH-POWER COMMUNICATIONS SATELLITE CONCEPT AND POSSIBLE APPLICATIONS

D. Koehn *In* ESA Satellite Broadcasting Feb. 1977 p 91-97 refs (For primary document see N77-23296 14-32)

Avail: NTIS HC A09/MF A01

A direct TV broadcasting satellite for supply of four TV channels to the Federal Republic of Germany is described. The concepts of both the satellite platform and the payload are sufficiently flexible to allow application in other service areas or telecommunication systems. Some general performance characteristics and possible implementations are discussed. Author (ESA)

N77-23308# Laboratoires d'Electronique et de Physique Appliquee, Paris Limeil-Brevannes (France).

ADVANCED TECHNIQUES FOR FUTURE SATELLITE TELEVISION RECEIVERS AT 12 GHz

J. Magarshack *In* ESA Satellite Broadcasting Feb. 1977 p 99-100 refs (For primary document see N77-23296 14-32)

Avail: NTIS HC A09/MF A01

Present day receivers and their limitations are analyzed. Improvements in the noise and cost of the front end can be expected by a purely FET (field effect transistor) conception in a monolithic integrated circuit construction. A study is being carried out on this concept and preliminary results are given of FET mixers, oscillators, and amplifiers. The problems of GaAs material yield will need to be solved but it can be expected that this receiver will be ready in the early 1980's. Author (ESA)

N77-23309# Etudes Techniques et Constructions Aerospatiales, Charleroi (Belgium).

A COHERENT PROGRAM OF TELEVISION RECEIVING STATION - FROM PROPAGATION EXPERIMENT TO DIRECT TELEVISION

R. Dardenne *In* ESA Satellite Broadcasting Feb. 1977 p 101-107 (For primary document see N77-23296 14-32)

Avail: NTIS HC A09/MF A01

The Belgian program of experimentation carried out to determine the specification and level of performance required for the receiving station of a television broadcast from a satellite is described. The experimental phase includes propagation measurements and television reception from the OTS satellite. The test program, including individual and community receiving station performance evaluation, is discussed briefly. A rough description of the hardware built for the experimental phase is given. Author (ESA)

N77-23310# Thomson-CSF, Levallois-Perret (France). Satellites and Earth Stations Dept.

GROUND COMMUNICATION EQUIPMENT AT 11/14 GHz

C. Bremenson *In* ESA Satellite Broadcasting Feb. 1977 p 109-116 (For primary document see N77-23296 14-32)

Avail: NTIS HC A09/MF A01

Ground communication equipment for 11/14 GHz is described. This equipment will be installed in two kinds of earth stations: OTS/ECS or Intelsat 5 earth stations for both transmit and receive telephone, TV, and data signals; and community TV receive only earth stations. For both kinds, earth station organization and earth station subassemblies are discussed.

Author (ESA)

N77-23311# Philips Gloeilampenfabrieken N. V., Eindhoven (Netherlands).

DIRECT RECEPTION EXPERIMENTS WITH THE CANADIAN 12 GHz COMMUNICATION TECHNOLOGY SATELLITE

J. W. Edens *In* ESA Satellite Broadcasting Feb. 1977 p 117-122 refs (For primary document see N77-23296 14-32)

Avail: NTIS HC A09/MF A01

The aims of the Communication Technology Satellite and some technical possibilities for carrying out its mission, especially the CBC broadcast experiments, are dealt with. A survey is given of the sites where terminals are located and the various properties recorded at these locations. These measurements can be important in determining how far various climatological conditions, such as temperature, wind speed, and precipitation influence the picture quality. Various parts of the terminal, such as the antennas, the frequency converter, and the FM-AM converter are described. The power budgets of the system, comprising the 1.6 m antenna and the 1.2 m antenna, are explained. Some early results are discussed. Author (ESA)

N77-23312# Standard Electrik Lorenz A.G., Stuttgart (West Germany).

INTEGRATED VIDEO-SOUND TRANSMISSION FOR TV SATELLITE TRANSMISSION

G. Steudel *In* ESA Satellite Broadcasting Feb. 1977 p 123-127 ref (For primary document see N77-23296 14-32)

Avail: NTIS HC A09/MF A01

A system is described for sound transmission making use of the time intervals of TV signals not occupied by the video signal. The system enables two high quality sound signals to be transmitted after PCM encoding in the somewhat modified horizontal blanking interval of the TV signal. Tests of the TV-PCM 6 system are described, and its application to satellite-to-earth transmission is discussed. ESA

N77-23313# Standard Electrik Lorenz A.G., Stuttgart (West Germany).

A TEST SYSTEM FOR DIGITAL SATELLITE TV TRANSMISSION

J. Wasser and W. Zschunke *In* ESA Satellite Broadcasting Feb. 1977 p 129-136 refs (For primary document see N77-23296 14-32)

Avail: NTIS HC A09/MF A01

It is shown that digital modulation methods for TV satellite transmission can offer advantages in satellite transmission power and bandwidth if the bit rate can be reduced to 34 Mbit/s. A very efficient coding technique, differential PCM (DPCM), is described and its application for TV transmission is shown. A test system for demonstrating the feasibility of digital TV transmission is described in detail. In this system the composite TV signal is split up into its components luminance and chrominance. After DPCM encoding these picture signals and accompanying sound signals are multiplexed and transmitted together with a code word for synchronization. At the receive side the signals are demultiplexed and provided after decoding as analog signals. Examples of digitally transmitted pictures are given which show, that a good picture quality has been achieved. Author (ESA)

N77-23314# European Space Research and Technology Center, Noordwijk (Netherlands). Attitude and Orbit Control Div.
THE IMPACT OF MISSION REQUIREMENTS ON ATTITUDE AND ORBIT CONTROL OF BROADCAST SATELLITES
C. A. Markland *In* ESA Satellite Broadcasting Feb. 1977 p 137-147 refs (For primary document see N77-23296 14-32)
Avail: NTIS HC A09/MF A01

An introduction is given to the problems of attitude and orbit control of broadcast satellites, and the links that exist between the user's mission requirements and the corresponding attitude and orbit control system are discussed. Past and present satellites are reviewed briefly, and the subject of geostationary orbit control is described in terms of the disturbing forces and the stationkeeping strategies. The design of attitude control systems for three axis stabilized satellites is presented in terms of disturbance torques, attitude sensors, and actuators and identifying the various system problems and solutions. Sources of pointing error and the formulation of error budgets are discussed, and several steps toward higher accuracy are proposed. Some comments are given regarding the achievable accuracy for this type of satellite.
Author (ESA)

N77-23315# AEG-Telefunken, Ulm (West Germany).
HIGH-POWER X-BAND SATELLITE TWT'S FOR DIRECT TV-BROADCASTING
D. Deml *In* ESA Satellite Broadcasting Feb. 1977 p 149-154 (For primary document see N77-23296 14-32)
Avail: NTIS HC A09/MF A01

Developments are reported of TWT's of a few hundred watts for the satellite direct TV broadcasting 12 GHz range. Developments took place for power levels of 200 W and multistage collector for achieving high efficiencies. 3-collector stages were used for the 200 W helix tube in order to meet 45 percent overall efficiency while the 450 W coupled cavity tube was designed to operate with 5 stages in order to meet 50 percent efficiency as a minimum. The special feature of both tubes is that the multistage collector is of self-radiating design and radiates the dissipated power into space at a temperature of approx. 300 C without any additional radiators. Author (ESA)

N77-23316# Thomson-CSF, Meudon-la-Foret (France). Dept. Espace-Satellites.
SATELLITE COMMUNICATION EQUIPMENT AT 14/11 GHz
V. Biggi *In* ESA Satellite Broadcasting Feb. 1977 p 155-161 (For primary document see N77-23296 14-32)
Avail: NTIS HC A09/MF A09

Equipment development for communication satellites is reviewed. The following components are briefly described: a breadboard model of a 14/4/11 GHz repeater, a 14/4 GHz mixer, the OTS 14/1 GHz mixer, the OTS output network at 11 GHz, the Marots 14/0.9/0.09 GHz receiver, a 20 W/12 GHz TWT, and a 100-150 W/12 GHz TWT. ESA

N77-23317# AEG-Telefunken, Wedel (West Germany).
POWER SUPPLY SYSTEMS IN THE MULTI-kW POWER RANGE
B. Gohrbandt and J. Rath *In* ESA Satellite Broadcasting Feb. 1977 p 163-168 (For primary document see N77-23296 14-32)
Avail: NTIS HC A09/MF A01

Flexible roll-out solar arrays and ac power distribution techniques in the multi-kW-range as they are currently under development are discussed. The state-of-the-art of these developments is explained. Author (ESA)

N77-23318# Etudes Techniques et Constructions Aerospatiales, Charleroi (Belgium).
DESIGN-TO-COST PHILOSOPHY FOR COMMUNICATION SATELLITES: THE EXAMPLE OF PHEBUS POWER SUPPLY
A. Dumont *In* ESA Satellite Broadcasting Feb. 1977 p 169-172 (For primary document see N77-23296 14-32)
Avail: NTIS HC A09/MF A01

The role of the different components of spacecraft power conditioning is considered from a cost point-of-view, and the Phebus layout is described. In this project the concept of reusing qualified equipment at the level of the mechanically packaged hardware is applied. Single model missions can therefore be run. The basic policy of using strictly the same hardware for a range of missions will allow cost reduction. ESA

N77-23319# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
PAYLOAD MASS INCREASE FOR FUTURE COMMUNICATION SATELLITES BY NEW ATTITUDE CONTROL AND PROPULSION METHODS
W. Goeschel and W. Schrempp *In* ESA Satellite Broadcasting Feb. 1977 p 173-179 (For primary document see N77-23296 14-32)
Avail: NTIS HC A09/MF A01

An attitude control is proposed, not requiring dynamic stability in a spinning mission phase and based on the propulsion technology developed for Symphonie. Bipropellant systems are proposed for injection and orbit control. Both topics result in considerable weight savings. A comparison of these methods with conventional methods is given, showing the merits of the new concept. Author (ESA)

N77-23320 Dornier-System G.m.b.H., Friedrichshafen (West Germany).
MECHANISMS FOR COMMUNICATIONS SATELLITES
M. Granzow and R. Ockert *In* ESA Satellite Broadcasting Feb. 1977 p 181-186 (For primary document see N77-23296 14-32)
Avail: NTIS HC A09/MF A01

The design parameters, layout, performance data, status of hardware, and fields of application of two mechanisms - the Bearing and Power Transfer Assembly (BAPTA) and the Antenna Pointing Mechanism (APM) - mainly applied in communications satellites are presented. The BAPTA provides orientation of the solar arrays and the transfer of power and signals between satellite body and array; the APM has to point the antenna beam mechanically by a gimballed system. Both mechanisms under developemnt are part of the governmental program for advanced satellite technology. Author (ESA)

N77-23321# Swedish Space Corp., Solna.
NORDSAT FEASIBILITY STUDY
F. Engstroem, L. Anderson, and S. Grahn *In* ESA Satellite Broadcasting Feb. 1977 p 187-192 (For primary document see N77-23296 14-32)
Avail: NTIS HC A09/MF A01

The background is given for a study presently in progress regarding the feasibility of exchanging TV and radio programs between the Nordic countries via a direct broadcasting satellite system. The basic technical requirements for the space and ground segments are described in general terms. The main characteristics of a possible system configuration are given. It is tentatively concluded that a total Nordic program exchange by 1981, using a direct broadcast satellite system, is technically feasible.
Author (ESA)

N77-23322# European Space Research and Technology Center, Noordwijk (Netherlands).
DESIGN AND CONSTRUCTION AT ESTEC OF A MAGNETICALLY SHIELDED ENCLOSURE FOR VLF
Paris ESA Jan. 1977 38 p refs
(ESA-TN-125) Avail: NTIS HC A03/MF A01

A magnetically shielded enclosure was constructed for the twin purposes of providing an enclosure in which the high environmental industrial field would be sufficiently reduced to enable sensitive measurements to be made on small test units and of appraising the theoretical and practical approaches in preparation for their application to a larger installation in the future. The theoretical background is dealt with and it is shown how the design parameters were derived in the light of the required performance. From a theoretical analysis of the shielding factor and the use of a correcting factor for nonideal shape, it was found that two layers of shielding material would be required, therefore the design optimization for a multi-shell enclosure was investigated. The mechanical aspects of design and manufacture are described as well as the method of construction and the ways in which the various problems concerning feedthroughs, handling procedures, and provision of services were solved. For individual titles, see N77-23323 through N77-23324. ESA

N77-23323# European Space Research and Technology Center, Noordwijk (Netherlands). Testing and Engineering Div.
THEORETICAL CONSIDERATIONS AND DESIGN PARAMETERS
P. Lequain *In* ESA Design and Construct. at ESTEC of a Magnetically Shielded Enclosure for VLF Jan. 1977 p 1-16 (For primary document see N77-23322 14-32)
Avail: NTIS HC A03/MF A01

The theoretical background of the construction of a magnetically shielded enclosure for VLF enabling sensitive measurements to be accomplished is described, and it is shown how the design parameters were derived in the light of the required performance. From a theoretical analysis of the shielding factor and the use of a correcting factor for nonideal shape, it was found that two layers of shielding material would be required; the design optimization for a multishell enclosure was therefore investigated. ESA

N77-23324# European Space Research and Technology Center, Noordwijk (Netherlands). Testing and Engineering Div.
DESIGN, MANUFACTURE AND CONSTRUCTION
J. A. Berkhout and J. Schouten *In* ESA Design and Construct. at ESTEC of a Magnetically Shielded Enclosure for VLF Jan. 1977 p 17-32 refs (For primary document see N77-23322 14-32)
Avail: NTIS HC A03/MF A01

The mechanical aspects of design and manufacture of a magnetically shielded enclosure for VLF are dealt with. The method of construction is described together with the ways in which the various problems concerning feedthroughs, handling procedures, and provision of services were solved. ESA

N77-23325# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
IMAGE INTENSIFIER FOR USE IN A TELEVISION SYSTEM Ph.D. Thesis - Ecole Natl. Super. de Phys. de Marseille [ETUDE D'UN INTENSIFICATEUR D'IMAGES EN VUE D'UNE UTILISATION DANS UN SYSTEME DE TELEVISION]
Vincent Cenalmor 19 Jun. 1975 113 p refs In FRENCH
(LAS-75-ELC-067-VC-HL) Avail: NTIS HC A06/MF A01

Equipment was investigated for photon counting, satisfying two functions: time separation of two photons arriving consecutively at the same point on a screen and spatial separation of two photons arriving at two different points of a screen. In order to meet these requirements, the target of a television tube was used for storing the image detected by a photocathode. Three types of equipment are presented to illustrate the evolution in photon counting over the past years. Some theoretical problems were studied for the realization of a counting circuit. The possibility of achieving such a circuit using an image intensifier with microchannel electron multiplier plate is discussed. ESA

N77-23326# Physics Lab. RVO-TNO, The Hague (Netherlands).
A STUDY OF DISCONTINUITIES IN RECTANGULAR WAVEGUIDE BY MODAL ANALYSIS. THE DESIGN OF A SINGLE STEP DIELECTRIC MATCHING TRANSFORMER
A. vanArdenne Mar. 1976 50 p refs
(Contract A71/KM/107)
(PhL-1976-12; TDCK-67568) Avail: NTIS HC A03/MF A01

The problem of some simple discontinuities in a waveguide was examined and the more complex problem of the design of a one step transformer of dielectric material was studied. The influence of the junctions of this design is dealt with. The matching problem of the junction was solved numerically by modal analysis. An experimental confirmation was found for the numerical results. The application of a single step transformer for matching a non-reciprocal ferrite phase shifter resulted in a bandwidth of 4 to 6 percent. In most cases this bandwidth is insufficient and a two step transformer must be applied. Some attention is paid to the design of a multi-step dielectric matching transformer.
Author (ESA)

N77-23327# Ticra A/S, Lyngby (Denmark).
DEVELOPMENT OF SPHERICAL NEAR-FIELD FAR-FIELD ANTENNA TEST TECHNIQUE, VOLUME 1 Final Report
Frank Jensen, Flemming HolmLarsen, and Knud Pontoppidan 29 Nov. 1976 162 p refs Prepared jointly with Tech. Univ. of Den. 2 Vol.
(Contract ESTEC-2478/75-AK)
(S-45-02-Vol-1; ESA-CR(P)-916-Vol-1) Avail: NTIS HC A08/MF A01

A spherical near-field far-field technique (SNFT) was developed and tested for satellite antennas to determine their radiation pattern. The technique is an alternative to a sufficiently long outdoor range, based on spherical probing of the near-field, followed by digital data processing to derive the far-field behavior; it also takes the satellite configuration into consideration. The SNFT was experimentally verified by measurements carried out in an anechoic chamber, and an agreement is shown for the processed far field and the measured far field. An investigation of the running costs of a test facility is presented. It is concluded that SNFT is a powerful and attractive alternative to the conventional far-field technique. ESA

N77-23328# Ticra A/S, Lyngby (Denmark).
SNIFT - COMPUTER PROGRAM FOR SPHERICAL NEAR-FIELD FAR-FIELD TECHNIQUE, VOLUME 2
Frank Jensen 29 Nov. 1976 28 p refs Prepared jointly with Tech. Univ. of Den. 2 Vol.
(Contract ESTEC-2478/75-AK)
(S-45-03-Vol-2; ESA-CR(P)-916-Vol-2) Avail: NTIS HC A03/MF A01

The program described performs the transformation of a satellite antenna near field, measured on a spherical surface, to the corresponding far field. The programming language used is FORTRAN 4. The transformation applies a Fourier transformation subroutine. A program listing is included. ESA

N77-23329# Siemens A.G., Munich (West Germany). Fachgebiet Weitverkehrstechnik.
CALCULATION, DESIGN AND EXPERIMENTAL INVESTIGATIONS OF THE CARRIER SUPPLY OF A TV BROADCASTING SATELLITE Final Report
Guenther Herbster and Karl Weinhardt Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 164 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-392)
(Contracts BMFT-RFT-2071; GfW-01AI-141)
(BMFT-FB-W-76-18) Avail: NTIS HC A08/MF A01; ZLDI, Munich DM 34.45

The general aspects for the design of a carrier supply for the transponder of a communication satellite are discussed in detail with special emphasis on long and short term frequency stability. A basic concept for the carrier supply of the planned German television broadcasting satellite is described; it is adaptable to all applicable combinations of frequencies and channel allocations. Several hardware approaches for the realization of the different main subunits were analyzed. It is shown that the primary dc power consumption plays the most important role, as the up-converters have to be operated with relatively high power level of the local oscillators. Author (ESA)

N77-23330# Siemens A.G., Munich (West Germany). Fachgebiet Weitverkehrstechnik.
VERNIER BEAM STEERING BY FEED SYSTEM DISPLACEMENT OF A SATELLITE REFLECTOR ANTENNA Final Report
Reinhard Bredow and Gerhard Schindler Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 131 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-394)
(Contracts BMFT-WRT-2073; GfW-RV-11-V-36/73)
(BMFT-FB-W-76-21) Avail: NTIS HC A07/MF A01; ZLDI, Munich DM 27.55

Several possibilities of vernier beam steering by displacement of the feed system for the transmit antenna of a TV broadcasting satellite were investigated. The influence of antenna parameters such as aperture shape, illumination function, and focal length was examined by means of aperture field method. Starting with the center fed prime focus reflector antenna (calculation by means of current distribution method) the electrical properties of the offset fed prime focus reflector and the Cassegrain fed reflector were derived and demonstrated in experiment. Lateral feed displacement and tilting of the subreflector turns out to be optimal for the prime fed and Cassegrain fed reflector, respectively. The

problems of a beam steering mechanism are discussed and possibilities for realization are shown. Author (ESA)

N77-23331# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
ENDO ATMOSPHERIC-EXO ATMOSPHERIC RADAR MODELING. APPENDICES, A-K, M Final Report
Robert J. Hancock and Fred H. Cleveland Jun. 1976 207 p 2 Vol.
(Contract F30602-73-C-0380)
(AD-A031480; RADC-TR-76-186-Vol-4-Pt-1) Avail: NTIS HC A10/MF A01 CSCL 17/9

Contents: Glossary; Software Modules used in the Radar Simulation Model; Variables used in the Radar Simulation Model; Table of Time Sharing Files; Tschebyscheff Filter Design Data; Digital Filter Design; Computer Program used in Reading Radar Cross Section Tapes; Computer Program for Imaging Coherent Short Pulse Target Data; TSAR Simulation Run Catalogues; Antenna Lobe Scanner Output Data; Interactive Radar Simulator Design Study; Radar Cross Section Analytic Model Descriptions; and Hewlett Packard 9820A Computer Program to Plot Filter Transfer Functions. GRA

N77-23332# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
ENDO ATMOSPHERIC EXO ATMOSPHERIC RADAR MODELING. RADAR CROSS SECTION MODELING, APPENDIX L
Robert J. Hancock and Fred H. Cleveland Jun. 1976 328 p
(Contract F30602-73-C-0380)
(AD-A031440; RADC-TR-76-186-Vol-4-Pt-2) Avail: NTIS HC A15/MF A01 CSCL 17/9

This effort is concerned with the development and inplementation of a set of digital computer programs that will augment the RADC digital computer radar simulation model procured under Contract F30602-72-C0393 (01707201). The computer programs shall consist of a sequence of subroutines that correspond to separate functions such as a chaff model, target model, propagation effects, and clutter model. The original radar simulation model will be expanded to include a bistatic capability and will include ECM and phase coded pulse compression receiver techniques. In addition, an interactive system has been designed for the simulation. Using an interactive display, an engineer would be able to understand what is happening by being able to observe results at several intermediate points in the problem. For example, an antenna pattern or waveform response to a target is more meaningful than a long table of numerical listings. Parts of the simulation were used by RADC for Deep Space Surveillance Radar (DSSR) waveform analysis, generating antenna patterns and tradeoffs involving phase shifter bit-size for the Advanced Space Defense Program (ASDP). The RADC radar simulation model is being used to support Seek Sail, Cobra Judy, Digital Coded Radar, and Seek Sentry. Author (GRA)

N77-23333# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL INVESTIGATION OF MICROSTRIP TRANSMISSION LINE AND COPLANAR WAVEGUIDE ON FERRITE SUBSTRATE M.S. Thesis
Hooshang Aminelahi Jun. 1976 138 p
(AD-A031868) Avail: NTIS HC A07/MF A01 CSCL 09/1

In the thesis both a microstrip transmission line and a coplanar waveguide on ferrite substrate were designed, constructed, and tested. The behavior of microstrip and coplanar waveguide was experimentally evaluated, using different biasing magnetic fields and directions. The experimental dispersion (omega-beta) and attenuation diagrams for both structures were compared with theoretical work based on perturbation theory. Also, the experimental results were compared with the existing work conducted by different authors. GRA

N77-23334# Air Force Weapons Lab., Kirtland AFB, N.Mex.
ANALYSIS AND SYNTHESIS OF AN IMPEDANCE-LOADED LOOP ANTENNA USING THE SINGULARITY EXPANSION METHOD Final Report
Ronald F. Blackburn Nov. 1976 162 p refs
(AD-A033089; AFWL-TR-76-182) Avail: NTIS HC A08/MF A01 CSCL 09/5

The purpose of the work is to show how the singularity expansion method (SEM) may be used to significantly simplify the calculation and synthesis of the response of a transmitting loop antenna excited by an electromagnetic pulse. Paralleling the well-known description of lumped circuits in terms of their poles and zeros, a compact representation of the loop antenna in terms of its poles and zeros is derived. The resulting time domain description of the loop response is simply a sum of terms involving the residues, the excitation, and the exponentially damped sinusoids whose complex frequencies are the frequencies at which radiation from a scatterer or antenna can take place without an applied excitation. One objective of this research is to investigate the possible use of the singularity expansion method to synthesize radiated time domain waveforms by uniformly loading a loop antenna. In particular, one wishes to choose the loading so as to realize some desired pole-zero configuration on the structure. GRA

N77-23335# Colorado Univ., Boulder. Electromagnetics Lab.
MODAL REPRESENTATION OF A HORIZONTAL WIRE ABOVE A FINITELY CONDUCTING EARTH Interim Report, 1 Nov. 1975 - 30 Apr. 1976
Edward F. Kuester and David C. Chang Sep. 1976 47 p refs
(Contract F19628-76-C-0099; AF Proj. 2153)
(AD-A032953; RADC-TR-76-287) Avail: NTIS HC A03/MF A01 CSCL 20/14

The modal representation of the fields of a thin horizontal wire (with or without dielectric coating) above the surface of a finitely conducting earth is discussed. A general expression for the excitation of the discrete modes by an aperture field of arbitrary form in the transverse plane is given. As a consequence, it is proved that any discrete mode can be excited with high efficiency with an aperture of finite size. The dependence of the discrete modal propagation constants of the discrete modes upon various physical parameters is investigated in some detail, and the possibility of mode degeneration is demonstrated. Field plots of the discrete modes are presented which show the qualitative differences between the so-called 'transmission-line' mode and the recently discovered 'earth-attached' mode. Author (GRA)

N77-23336# Mission Research Corp., Santa Barbara, Calif.
ANALYTIC SGEMP ANALYSIS FOR A PERFECTLY CONDUCTING SPHERE
Roger Stettner May 1976 73 p refs
(Contract DNA001-76-C-0086; DNA Proj. NWED-QAXEB069)
(AD-A033536; MRC-R-269; DNA-4033T) Avail: NTIS HC A04/MF A01 CSCL 20/3

An SGEMP skin current analysis is made for linear and non-linear source current limits. Some useful numerical data is presented. It appears that, under most circumstances, the fully time-dependent solution is necessary to describe the sphere response for only one or two modes. The remaining response may be described quasi-statically. GRA

N77-23337# Rome Air Development Center, Griffiss AFB, N.Y.
VLF/LF REFLECTIVITY OF THE POLAR IONOSPHERE, 4 MAY - 5 JULY 1975
John E. Rasmussen, Ralph J. McLain, John P. Turtle, and Wayne I. Klemmetti Aug. 1976 29 p refs
(AD-A034023; RADC-TR-76-270) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report provides a summary of high latitude ionospheric reflectivity as observed by the USAF high resolution VLF/LF ionosounder operating in northern Greenland. Ionospheric reflectivity parameters, including reflection heights and coefficients, are presented as a function of time of day. VLF long path propagation measurements, along with magnetometer and riometer data, are presented as supplemental information. Author (GRA)

N77-23338# Air Force Geophysics Lab., Hanscom AFB, Mass.
ANALYSIS OF AN ASYMMETRIC DOPPLER VELOCITY PATTERN Interim Report
Ralph J. Donaldson, Jr., Rosemary M. Dyer, Michael J. Kraus, and James F. Morrissey 7 Dec. 1976 5 p refs Presented at 17th Conf. on Radar Meteorol., Seattle, 26-29 Oct. 1976
(AF Proj. 6672)
(AD-A034077; AFGL-TR-76-0290) Avail: NTIS HC A02/MF A01 CSCL 04/2

Plan-view velocity contours of storms are routinely obtained on the color display of the AFGL Porcupine Doppler radar as its antenna rotates in azimuth with a fixed elevation angle. After each azimuth scan, the elevation angle is stepped to a new value and a refreshed velocity pattern is displayed. In a widespread stratiform storm, the elevated contours of Doppler velocity were remarkably asymmetric, producing a pattern strikingly similar to a Yin-Yang symbol. Fourier analysis of the variation with azimuth of the recorded velocities, however, revealed azimuthal symmetry of velocity components at any given range and elevation angle, indicating at each height an essentially homogeneous wind field which veered appreciably with increasing altitude and displayed a speed maximum well below the top of the precipitation. There were also a number of minor small-scale perturbations superimposed on the major wind field. Author (GRA)

N77-23339# Defense Systems Management School, Fort Belvoir, Va.

NEW RADAR FOR THE F-13: A DISCOUNTED CASH FLOW ANALYSIS

Porter W. Venn May 1976 28 p refs

(AD-A033918) Avail: NTIS HC A03/MF A01 CSCL 05/3

This report is a case study on the application of economic analysis and discounted cash flow techniques as an input to the decision making process regarding the acquisition of major weapon systems. The case contains four separate parts, which include: A. Application of economic analysis in the selection of the best of two alternative acquisition strategies for the installation of a new radar on a fighter aircraft already in the operational inventory - modification of an existing radar presently being installed on another aircraft or development of an advanced state of the art radar. B. Introduction of uncertainty and its impact on the acquisition decision. Several of the applicable cash flows are converted from a point estimate to a discrete probability distribution and the expected value of cash flows must be determined. C. Application of discounted cash flow analysis to three alternative production methods envisioned by a prospective manufacturer of the radar. The alternatives include subcontracting, modification of an existing production line, and purchase of a fully automated production line. D. Introduction of increased volume and its impact on the selection of the best production methodology. Author (GRA)

N77-23340# Stanford Telecommunications, Inc., Mountain View, Calif.

DEFINITION OF REAL-TIME ADAPTIVE CONTROL (RTAC) OF THE DEFENSE SATELLITE COMMUNICATIONS SYSTEM (DSCS). VOLUME 1: EXECUTIVE SUMMARY Final Report, Jul. 1975 - Aug. 1976

Jackson T. Witherspoon 30 Aug. 1976 70 p refs

(Contract DCA100-75-C-0062)

(AD-A034506; STI-TR-6001-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report summarizes the concept definition study for a real-time adaptive control (RTAC) system which is being planned for the Defense Satellite Communications System (DSCS) for the post 1980 era. RTAC will permit a significant increase in the steady-state capacity of the DSCS, and will permit rapid reconfiguration of network connectivity to match changing traffic loads. Control will evolve from today's predominantly manual control operation, through an initial control system (ICS) to the RTAC system of the post 1980 era. Author (GRA)

N77-23341# Stanford Telecommunications, Inc., Mountain View, Calif.

DEFINITION OF REAL-TIME ADAPTIVE CONTROL (RTAC) OF THE DEFENSE SATELLITE COMMUNICATIONS SYSTEM (DSCS). VOLUME 3: RTAC SYSTEM ALTERNATIVE ANALYSES Final Report, Jul. 1975 - Aug. 1976

Richard Alvarez, Herman Bustamante, Horen Chang, and Jackson T. Witherspoon 30 Aug. 1976 216 p refs

(Contract DCA100-75-C-0062)

(AD-A034507; STI-TR-6001-Vol-3) Avail: NTIS HC A10/MF A01 CSCL 17/2

This report presents the results of a concept definition study for a real-time adaptive control (RTAC) system which is being planned for the Defense Satellite Communications System (DSCS) for the post 1980 era. In particular, this volume details the DSCS system model used during the study and the major tradeoffs accomplished, with emphasis on individual functional areas. Author (GRA)

N77-23342# Stanford Telecommunications, Inc., Mountain View, Calif.

DEFINITION OF REAL-TIME ADAPTIVE CONTROL (RTAC) OF THE DEFENSE SATELLITE COMMUNICATIONS SYSTEM (DSCS). VOLUME 4: DCS SYSTEM CONTROL/TRAC INTERFACE CONCEPT STUDY Final Report, Jul. 1975 - Aug. 1976

R. Foerster, A. Pan, and T. Ranweiler 30 Aug. 1976 132 p refs

(Contract DCA100-75-C-0062)

(AD-A034508; STI-TR-6001-Vol-4) Avail: NTIS HC A07/MF A01 CSCL 17/2

This report presents the results of a concept definition study for a real-time adaptive control (RTAC) system which is being planned for the Defense Satellite Communications System (DSCS) for the post 1980 era. In particular, this volume develops operational concepts for the interface between the Defense Communications System (DCS), system control (SYSCON), and RTACs. Author (GRA)

N77-23343# Stanford Telecommunications, Inc., Mountain View, Calif.

DEFINITION OF REAL-TIME ADAPTIVE CONTROL (RTAC) OF THE DEFENSE SATELLITE COMMUNICATIONS SYSTEM (DSCS). VOLUME 5: COMPUTER PROGRAM DESCRIPTION AND DEVELOPMENT FOR A REAL-TIME ADAPTIVE CONTROL STUDY Final Report, Jul. 1975 - Aug. 1976

G. D. Heinz and G. O. Trebaol 30 Aug. 1976 128 p refs Prepared by ESL, Inc., Sunnyvale, Calif.

(Contract DCA100-75-C-0062)

(AD-A034509; STI-TR-6001-Vol-5) Avail: NTIS HC A07/MF A01 CSCL 17/2

This report presents the results of a concept definition study for a real-time adaptive control (RTAC) system which is being planned for the Defense Satellite Communications System (DSCS) for the Post 1980 era. In particular, this volume describes a computer-based system performance model used to analyze the effective performance improvements to be expected from RTACs. Author (GRA)

N77-23344# California Univ., Los Angeles. Dept. of Engineering Systems.

FREQUENCY DOMAIN INTERPOLATION Interim Report

Cornelius T. Leondes and Daniel D. Rivers 1976 17 p refs

(Grant AF-AFOSR-2958-76)

(AD-A033967; AFOSR-76-1405TR) Avail: NTIS HC A02/MF A01 CSCL 09/4

A formula is derived for interpolation between output samples of an FFT, i.e., in the frequency domain. Such a formula is useful for obtaining greater frequency resolution when two coarse FFT outputs are available. Consideration is also given to the effect of such interpolation on a weighted FFT. Author (GRA)

N77-23345# Naval Research Lab., Washington, D. C.

A FIDELITY AND STABILITY INVESTIGATION OF SOLID-STATE TRANSCEIVER MODULES Final Report

Harry E. Barlow 1 Nov. 1976 40 p refs

(WF12141601)

(AD-A033863; NRL-8051) Avail: NTIS HC A03/MF A01 CSCL 09/5

The pulse-to-pulse replication fidelity of solid-state microwave transceiver modules was investigated in terms of performance parameters of an AEW system. The overall distortion introduced by representative state-of-the-art modules was categorized and measured. A first-order time-domain analysis was made, relating nonideal module phase and amplitude response variations which occur as a function of the operating bandwidth to the system time-sidelobe response. Pulse trains consisting of various numbers of contiguous pulses were recorded, and spectral analyses were performed on the recorded data. The measurement apparatus used a carrier-suppression technique to permit observation of the relatively low levels of module-induced distortion. It was found that the level of distortion introduced by the module was significantly below (some 13 to 16 db lower than) values which

might affect the detection capability of present-day AEW systems. Author (GRA)

N77-23346# Aerospace Corp., Washington, D.C.
TECHNOLOGY ASSESSMENT FOR SPECTRUM MANAGEMENT Final Report
30 Jun. 1976 294 p refs
(Contract OTP-TP-5AC018)
(PB-263615/7; ATR-76(7542-03)-1; OTP-77-04c) Avail: NTIS HC A13/MF A01 CSCL 17B

The methodology uses the approach of comparing the spectrum utilization efficiency of the existing radio service with that of postulated alternatives generated by the assessor. Comparisons of the spectrum efficiency of these systems (the existing ones and alternatives) allow the assessor and the decision maker who receives the assessment to evaluate the difficulty of increasing spectrum utilization in this service, since costs, impact of using the alternative for the users of this service, the state of the service, and recommended action are all included in the assessment. GRA

N77-23347# Naval Research Lab., Washington, D. C. Radar Div.
A SIMPLE METHOD OF HEIGHT DETERMINATION USING FAN-BEAM SEARCH RADARS Interim Report
Ben H. Cantrell 14 Dec. 1976 9 p refs
(NRL Proj. R02-97; RR0210541)
(AD-A034670; NRL-8088) Avail: NTIS HC A02/MF A01 CSCL 17/9

A simple angle-measurement technique for a 2D search radar is described. Its features are accurate elevation and azimuth measurements which are only slightly affected by multipath and are roll and pitch tolerant. Furthermore, a radar using this technique can be constructed for a relatively low cost. GRA

N77-23348# Illinois Univ., Urbana-Champaign. Electromagnetics Lab.
STUDY OF MUTUAL COUPLING BETWEEN TWO SLOTS ON A CYLINDER Final Report, 16 Jul. - 15 Nov. 1976
S. W. Lee and R. Mittra Nov. 1976 70 p refs
(Contract N00019-76-M-0622)
(AD-A034095) Avail: NTIS HC A04/MF A01 CSCL 09/5

Contents: Calculation of Mutual Admittance between Two Slots on a Cylinder; Asymptotic Solution of Surface Field Due to a Magnetic Dipole on a Cylinder. GRA

N77-23349# Haskins Labs., New Haven, Conn.
ACOUSTIC CUES IN NATURAL SPEECH: THEIR NATURE AND POTENTIAL USES IN SPEECH RECOGNITION Final Report, 1 Mar. 1973 - 30 Nov. 1976
Franklin S. Cooper Nov. 1976 16 p refs
(Contracts N00014-67-A-0129-0002; N00014-76-C-0591)
(AD-A033628) Avail: NTIS HC A02/MF A01 CSCL 17/2

This final report summarizes the work carried out to study those acoustic cues in natural speech that are of potential use for speech-recognition purposes. The principal objectives of the program were: (a) to carry out basic research on automatically identifying the acoustic cues of natural speech. This research was aimed to bear directly on the scientific problems encountered in building a Speech Understanding System; and (b) to work closely with the principal contractors in the program whose tasks were to build complete speech-understanding systems. It was expected that this close cooperation would allow the research results to be quickly incorporated in these systems and their usefulness to be readily evaluated. GRA

N77-23350# Naval Electronics Lab. Center, San Diego, Calif.
RESULTS OF A-7 ALOFT BOTTOMS UP MODEL AND WEIGHT SENSITIVITY ANALYSIS Research and Development Report, Jul. 1975 - Jun. 1976
R. A. Greenwell 26 Jul. 1976 60 p refs
(AD-A033767; NELC-TR-1998) Avail: NTIS HC A04/MF A01 CSCL 17/2

A summary of data collected on fiber-optic and hard-wired communication-channel costs for the A-7 ALOFT is presented with the weight sensitivity to total system costs. Author (GRA)

N77-23351# Mitre Corp., Bedford, Mass.
CVSD PROCESSING OF QUASI-ANALOG SIGNALS, IMPLICATIONS FOR TRI-TAC APPLICATIONS. VOLUME 2: NSA CVSD
T. E. Allen, E. J. Boyle, Jr., R. A. Costa, and C. R. Husbands Oct. 1976 223 p refs
(Contract F19628-77-C-0001)
(AD-A034219; MTR-3250-Vol-2; ESD-TR-76-276-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 17/2

In support of the USAF Program Office element of TRI-TAC, a series of laboratory and field environment tests were conducted by the Mitre Corporation to assess Continuously Variable Slope Delta (CVSD) modulation techniques for processing of quasi-analog signals. The results of these tests are presented in four volumes. This volume, Volume II, presents results of testing with the NSA CVSD. Author (GRA)

N77-23352# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A TERMINAL ACCESS CONTROL SYSTEM FOR FLEETSAT
John D. Bridwell 22 Nov. 1976 75 p refs Sponsored in part by Navy
(Contract F19628-76-C-0002)
(AD-A034813; ESD-TR-76-323; TN-1976-29) Avail: NTIS HC A04/MF A01 CSCL 17/2

Lincoln Laboratory's Terminal Access Control System (TACS) provides demand assigned time division multiple access TDMA to GAPSAT or FLEETSAT 25 kHz channels. TACS is centrally controlled by a multiple access controller (MAC), nominally located at a shore station. Users of TACS who can be on shorebased or mobile platforms, enter requests for service via a Terminal Access Controller (TAC). The TAC provides error control and data buffering functions in addition to demand assignment control. The MAC automatically responds to the user request with an assignment or busy indication. TACS initially will utilize WSC-3 radios and modems, modified for 19,200 symbol per second operation and for rapid turn around time. TDMA frame formats are designed to maximize system efficiency and utility. For example, a mobile platform equipped with one half duplex WSC-3 has use of two 2.4 kbps circuits simultaneously. A platform with a full duplex radio has use of four such circuits. Author (GRA)

N77-23353# IIT Research Inst., Annapolis, Md.
TACTICAL COMMUNICATIONS ANALYSIS PROGRAM USER'S MANUAL Final Report
George W. Imhof Nov. 1976 72 p refs Supersedes ESD-TR-74-070 Sponsored in part by Navy
(Contract F19628-76-C-0017)
(AD-A034952; ESD-TR-76-008; ESD-TR-74-070) Avail: NTIS HC A04/MF A01 CSCL 17/2

The Tactical Communications Analysis Program (TACP) User's Manual describes the applicability of, data required for, and operational instructions for the TCAP. The TCAP was developed for the U.S. Marine Corps to perform electromagnetic compatibility analyses of snapshot deployments of tactical communications equipment operating in the HF (2-30 MHz), VHF (30-76 MHz), and UHF (225-400 MHz) frequency bands. This manual supersedes ESD-TR-74-070. Author (GRA)

N77-23354# IIT Research Inst., Annapolis, Md.
PERFORMANCE OF THE COSITE ANALYSIS MODEL (COSAM) FOR SELECTED HF EQUIPMENTS Final Report
M. Lustgarten, M. Maiuzzo, and S. Schneider Nov. 1976 150 p refs
(Contract F19628-76-C-0017; AF Proj. 649E)
(AD-A034924; ESD-TR-76-010) Avail: NTIS HC A07/MF A01 CSCL 17/2

Predictions using the Cosite Analysis Model (COSAM), developed by the DoD Electromagnetic Compatibility Analysis Center (ECAC), were compared with measurements of numerous interactions at a typical cosite installation. The tests involved AM and SSB equipments operating in the 2-30 MHz HF range. Measured data are provided. Twenty-five frequency assignments were tested, each with several desired-signal levels. The types of interactions compared included adjacent signals, spurious responses, spurious emissions, and receiver and transmitter intermodulation. Author (GRA)

N77-23355# Lincoln Lab., Mass. Inst. of Tech., Lexington.
WIDEBAND 10.6 MICROMETERS BACKSCATTER RANGE
Louis R. Tomasetta, Gary M. Carter, and Marcus S. Edelstein
2 Nov. 1976 72 p refs
(Contract F19628-76-C-0002; ARPA Order 600)
(AD-A034812; ESD-TR-76-321; LRP-4) Avail: NTIS HC A04/MF A01 CSCL 17/5

This report summarizes the principles, hardware and performance of a high resolution 10.6 micrometer optical backscatter range. Included is a description of the backscatter range, optical setup, and processing capabilities. Results include demonstration of the high resolution range and Doppler capabilities of the wideband waveform as well as the first high resolution 10.6 micrometer range-resolved angel-angle scanned and range-Doppler images. GRA

N77-23356# Defense Communications Engineering Center, Reston, Va.
DCS DIGITAL TRANSMISSION SYSTEM PERFORMANCE
K. W. Kirk and J. L. Osterholz Nov. 1976 135 p refs
(AD-A034498; TR-12-76) Avail: NTIS HC A07/MF A01 CSCL 17/2

The report defines suitable circuit and channel performance measures for DCS digital transmission systems. These performance measures are allocated among various segments of a global reference circuit. Relationships are presented which allow basic system design characteristics such as RF link fade margin and individual equipment mean-time-between-outage performance to be chosen that satisfy the selected end-to-end circuit performance measures. A DCS Terrestrial Digital Transmission System Specification is attached as an appendix to this report. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N77-23357 Michigan State Univ., East Lansing.
AN EXPERIMENTAL AND THEORETICAL STUDY ON THE INTERACTION OF ELECTROMAGNETIC FIELDS WITH ARBITRARILY SHAPED BIOLOGICAL BODIES Ph.D. Thesis
Bhag Singh Guru 1976 208 p
Avail: Univ. Microfilms Order No. 77-5810

An experimental verification of the numerical technique for calculating the electric field induced inside and scattered by biological systems of arbitrary shape and composition, when irradiated by an electromagnetic wave is presented. A basic theoretical approach leading to an integral equation is introduced. The integral equation method is applied to quantify the induced electric field and absorbed power density inside cell samples and these results are verified by total absorbed power and heat dissipation techniques. Some chromosomal aberrations were observed experimentally in human amnion and lymphocyte cells when irradiated by microwaves with intensities lower than the safety standard. Dissert. Abstr.

N77-23358 Wisconsin Univ., Madison.
DESIGN, CHARACTERIZATION AND EXPLORATORY APPLICATIONS OF A COMPUTER-BASED INSTRUMENT FOR PULSE VOLTAMMETRY AT STATIONARY ELECTRODES Ph.D. Thesis
Steven Charles Rifkin 1976 202 p
Avail: Univ. Microfilms Order No. 76-28931

A computer-based instrument was chosen to investigate the analytical utility of pulse voltametry at stationary electrodes. Normal or differential pulse waveforms could be generated by software which used programmable interval timers interfaced to the computer for control of pulse lengths and times of data acquisition. A previously derived general equation giving the current for a reversible reaction at any time after an arbitrary number of step functional potential changes of arbitrary duration and direction is presented and discussed. The effects of changing various parameters in this equation were tested using the oxidation of 9, 10-diphenylanthracene at a platinum electrode in acetonitrile as a test system. Dissert. Abstr.

N77-23359 Cornell Univ., Ithaca, N.Y.
COMPUTER SIMULATION OF TRAPATT DEVICE-CIRCUIT INTERACTIONS Ph.D. Thesis
Zeev Isaac Bogan 1976 176 p
Avail: Univ. Microfilms Order No. 77-5725

A computer simulation is presented of device-circuit interactions in coaxial TEM-mode Time-Delay-Triggered TRAPATT Circuits, as well as simulations of related problems such as relaxation oscillations and a comparison of dc to RF conversion efficiencies of complementary TRAPATT devices. A comparison of the conversion efficiencies of two complementary TRAPATT structures was carried on under the constraint of a square wave external current. This analysis confirmed experimental reports that stated that in some circumstances the N(+)P structure is more efficient than its complementary P(-)N. Special emphasis was put on the analysis of the turn-on transient in a coaxial TRAPATT circuit. Ways of reducing the turn-on time in practical circuits are suggested here on the basis of this analysis.
Dissert Abstr.

N77-23360 California Univ., Berkeley.
CHARACTERISTICS OF METAL-BARRIER-METAL DIODES AND THEIR APPLICATIONS Ph.D. Thesis
Sadeg Mustafa Faris 1976 132 p
Avail: Univ. Microfilms Order No. 77-4448

Room temperature metal-barrier-metal (MBM) tunneling diodes were recently used in many detection and harmonic mixing experiments. The nonlinearity of MBM diodes is investigated both experimentally and theoretically and several practical applications are discussed. The detection experiments at optical frequencies result in many signal vs bias curves the shapes of which take a striking evolution as the junction resistance is changed. This evolution is predicted from theoretical investigation of the detection process based on Simmons electron tunneling model. Dissert. Abstr.

N77-23361 Oklahoma State Univ., Stillwater.
SPECTRAL CHARACTERIZATION OF MULTI-INPUT DYNAMIC SYSTEMS Ph.D. Thesis
S. Srinathkumar 1976 130 p
Avail: Univ. Microfilms Order No. 77-5192

A multi-input synthesis procedure formulated as an eigenvalue/eigenvector assignment problem is developed. The utility of the theory is demonstrated by designing stability augmentation systems for an aircraft and helicopter. The pivotal role the closed-loop modal matrix (matrix of eigenvectors) plays in characterizing varied attributes of the feedback system makes the formulation potentially applicable to many related multivariable synthesis problems. Dissert. Abstr.

N77-23362 California Univ., Berkeley.
NONUNIFORM PULSE CODE MODULATION ENCODING USING INTEGRATED CIRCUIT TECHNIQUES Ph.D. Thesis
Yannis Tsividis 1976 301 p
Avail: Univ. Microfilms Order No. 77-4629

Techniques for integrated circuit implementation of nonuniform pulse code modulation voice encoders were examined. An encoder scheme is proposed, which is realized as a single NMOS integrated circuit. An internally compensated NMOS operational amplifier was designed and fabricated. A computer program was developed for the simulation of PCM encoders and decoders, which was used to determine the effect of component nonidealities on the performance of the proposed encoder scheme.
Dissert. Abstr.

N77-23363 Missouri Univ., Columbia.
COMPUTERIZED PATCHING FOR POWER SYSTEM HYBRID SIMULATOR Ph.D. Thesis
Daniel Tai-Yui Wong 1976 221 p
Avail: Univ. Microfilms Order No. 77-4969

The unique topological characteristics possessed by an electric

power system are used to develop the two techniques for minimizing the total number of switches required for a COMPAT system. The first technique, the restricted-connection technique, utilizes the restrictions of the interconnectivity between different power-system components. The second technique, the modularization technique, breaks a simulated system into a number of modules, then the intramodule connections are made within each module, and the intermodule connections are made by an intermodule-connection block. Both techniques significantly reduce the number of switches required for a COMPAT system. The strictly nonblocking, three-stage switching matrix that further saves the number of switches is derived. The formulation of eleven major hybrid-simulation models of electric power-system components suitable for computerized patching and their characteristics are described. Dissert. Abstr.

N77-23364 California Univ., Berkeley.
A PIEZOELECTRIC DIFFUSED MOS (PI-DMOS)STRAIN TRANSDUCER Ph.D. Thesis
Keming Wayne Yeh 1976 191 p
Avail: Univ. Microfilms Order No. 77-4660

A new type of fast, sensitive strain transducer is described. The device, a piezoelectric diffused MOS transistor (PI-DMOS), is basically a double-diffused MOS transistor (D-MOST) with a piezoelectric layer of zinc oxide incorporated as part of the gate insulator. The device is fabricated by procedures that are compatible with standard planar integrated-circuit processing. The device responses to low frequency strains and acoustic waves were analyzed theoretically. Experimental results show good correspondence to theoretical predictions. Theoretical analysis indicates that the strain sensitivity extends from dc to the range of the D-MOST cut-off frequency which is in the order of GHz. Laboratory techniques aimed at improving the sputtering deposition of oriented ZnO piezoelectric films were extensively studied. It is shown that control of substrate temperature, sputtering rate, gas content and pressure are important to optimize the orientation of the sputtered piezoelectric films.Dissert. Abstr.

N77-23365*# Stanford Research Inst., Menlo Park, Calif.
PHOTOCONDUCTIVITY OF HIGH VOLTAGE SPACE INSULATING MATERIALS: MEASUREMENTS WITH METAL ELECTRODES Interim Technical Report, 1 Jul. 1974 - 1 Apr. 1975
H. T. Coffey and J. E. Nanevicz Apr. 1975 31 p
(Contract NAS3-18912; SRI Proj. 3445)
(NASA-CR-152839; ITR-1) Avail: NTIS HC A03/MF A01 CSCL 09C

The electrical conductivities of high voltage insulating materials were measured in the dark and under various intensities of illumination. The materials investigated included FEP Teflon, Kapton-H, fused quartz, and parylene. Conductivities were determined as functions of temperature between 22 and 100 C and light intensity between 0 and 2.5 kW/m2. The thickness dependence of the conductivity was determined for Teflon and Kapton, and the influence of spectral wavelengths on the conductivity was determined in several cases. All measurements were made in a vacuum to simulate a space environment, and all samples had metallic electrodes. The conductivity of Kapton was permanently increased by exposure to light; changes as great as five orders of magnitude were observed after six hours of illumination. Author

N77-23366*# Litton Industries, San Carlos, Calif. Electron Tube Div.
A 200 WATT TRAVELING WAVE-TUBE FOR THE COMMUNICATIONS TECHNOLOGY SATELLITE Final Report
C. L. Jones Nov. 1976 238 p refs
(Contract NAS3-15830)
(NASA-CR-135029) Avail: NTIS HC A11/MF A01 CSCL 09A

The results of the design, development, and test of experimental and production units of PPM focused traveling wave tube that produces 225 watts of CW RF power over 85 MHz centered at 12.080 GHz are presented. The tube uses a coupled cavity RF circuit with a velocity taper for greater than 26 percent basic efficiency. Overall efficiency of 50 percent is achieved by the incorporation of a multistage depressed collector designed at NASA Lewis Research Center. The collector is cooled by direct radiation to deep space. The tube was designed to be used for broadcasting power transmission from a satellite. Author

N77-23367# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF THE THERMAL STATE OF AN ASYNCHRONOUS MACHINE ON ITS CHARACTERISTICS
Yu. V. Gaintsev Jun. 1976 10 p ref Transl. into ENGLISH from Elektrotekhnika (Moscow), vol. 3, 1975 p 20-21
(RAE-Lib-Trans-1885; BR55579) Avail: NTIS HC A02/MF A01

The effect of the thermal state of a low voltage asynchronous machine of closed air cooled design on its characteristics is examined. Variation in the air gap during heating of the machine is evaluated. The effect of the thermal state on additional losses and additional torques and the effect of the variation of the thermal state of machines on the power characteristics were studied. Author

N77-23368# California Univ., Livermore. Lawrence Livermore Lab.
DERIVATION OF SIMPLE POLES IN A TRANSFER FUNCTION FROM REAL-FREQUENCY INFORMATION. PART 2: RESULTS FROM REAL EM DATA
J. N. Brittingham, E. K. Miller, and J. L. Willows 23 Aug. 1976 65 p refs
(Contract W-7405-eng-48)
(UCRL-52118) Avail: NTIS HC A04/MF A01

A technique for finding the simple poles in a transfer function, F(s), from real-frequency was tested against specified pole sets. A modification of the original procedure, which takes advantage of the fact that $F^*(s) = F(s^*)$, is presented and applied to electromagnetic transfer functions. The electromagnetic poles thus obtained are invariant with respect to excitation and observable phenomena (e.g., current, field, etc.) to which the transfer function corresponds, as long as the system is overdetermined. Varying the frequency interval over which data are available also demonstrates the validity of the technique. ERA

N77-23369# European Space Agency, Noordwikj (Netherlands). Space Science Dept.
THE MULTIPLE APPLICATIONS OF ELECTRON EMITTERS IN SPACE
Rejean J. L. Grard Oct. 1976 36 p refs Presented at the USAF/NASA Spacecraft Charging Technol. Conf., U.S. Air Force Acad., Colo., 27-29 Oct. 1976
Avail: NTIS HC A03/MF A01

The principles which govern the interaction of a spacecraft with its environment are recapitulated, and the various techniques available for controlling the electrostatic potential of a spacecraft are reviewed. It is demonstrated that electron emitters are requisite to any scientific mission in a magnetospheric environment, in the vicinity of Jupiter in particular. It is also emphasized that electron sources can be used simultaneously for a number of additional tasks such as monitoring the degradation of spacecraft material surfaces, converting the thermal motion of plasmas into electrical energy, measuring the density and temperature of the ambient electrons, and receiving waves without antennas. Author (ESA)

N77-23370# Army Construction Engineering Research Lab., Champaign, Ill.
INVESTIGATION OF GROUND FAULT CIRCUIT INTERRUPTER Final Report
W. D. Ford and R. G. McCormack Sep. 1976 126 p refs
(DA Proj. 4A7-62719-AT-41)
(AD-A031781; CERL-TR-E-92) Avail: NTIS HC A07/MF A01 CSCL 09/1

The objective of this study was to ascertain the capabilities and limitations of the Ground Fault Circuit Interrupters (GFCI) used on Corps of Engineers (COE) supervised construction sites. Laboratory tests were conducted to determine (1) if GFCI samples from different manufacturers met the trip threshold design specifications of 5 mA plus or minus and (2) if condensation, hot-cold environment, vibration, and RF, UHF, and microwave fields adversely affected their operation. A limited field survey of COE supervised construction sites was conducted to evaluate

the actual application of the GFCI. This survey included trip threshold measurements and discussions with COE and contractor personnel after nuisance tripping had occurred. GRA

N77-23371# Army Electronics Command, Fort Monmouth, N. J.
GUNHARDENED CRYSTAL OSCILLATORS FOR REMOTELY MONITORED BATTLEFIELD SENSOR SYSTEM
E. Hafner, S. S. Schodowski, J. R. Yig, and H. Mazurczuk Oct. 1976 20 p refs
(DA Proj. 1S7-62705-AH-94)
(AD-A033461; ECOM-4441) Avail: NTIS HC A02/MF A01 CSCL 09/5

The genesis of a temperature compensated voltage controlled (for FSK modulation) crystal oscillator capable of maintaining a 5 ppm accuracy in either FSK state (mark and space) under conditions of 15,000g shock, -40C to -75C ambient temperature, and aging for one year is described. The thick film microcircuit oscillator occupies less than 0.5 cubic inches and consumes less than 50 mW of power. The development of the requisite crystal unit required a large number of design and processing innovations whose significance, aside from the shock resistance, transcend their immediate application to the REMBASS oscillator. Among them is a new family of microcircuit compatible ceramic flatpack crystal enclosures; a laser assisted X-ray goniometer for precision angle measurements; novel surface preparation and cleaning procedures definitized with the aid of high energy electron diffraction, scanning electron microscopy and Auger spectroscopy; and the concept of a novel in-line, ultrahigh vacuum processing facility to assure long term stability. Finite element computer studies aided in the shockproofing of the resonators, and 20 MHz crystal units that survived 36,000g shock and remained within the assigned frequency tolerance at 15,000g have been fabricated. GRA

N77-23372# Army Electronics Command, Fort Monmouth, N. J.
FAST ELECTRONIC TUNING OF HIGH POWER CIRCUITS FOR UHF POWER AMPLIFIER
George C. Fincke Oct. 1976 20 p refs
(DA Proj. 1S7-62705-AH-94)
(AD-A032495; ECOM-4445) Avail: NTIS HC A02/MF A01 CSCL 09/5

A technique was developed for fast tuning (one microsecond) a coaxial cavity power amplifier to utilize the several advantages of narrowband power over an octave frequency range at UHF. The method described incorporates PIN diodes and is similar to that previously developed for VHF power output systems. Power output and frequency range objectives were not achieved due to the choice of a conventional pi-network output circuit. An improved output circuit is proposed in order to meet design goals for power output and frequency range. This fast-tuning technique, applied to a multiplexer-power combiner, is suggested as a method of overcoming the three decibels of power loss usually associated with the use of binary wideband hybrid combiners for multi-tone operation. Author (GRA)

N77-23373# General Dynamics Corp., San Diego, Calif. Electronics Div.
VARIABLE PERMITTIVITY LIQUID PHASE SHIFTERS Final Technical Report, Jun. 1975 - Jul. 1976
William Bottenberg Griffiss AFB, N.Y. RADC Oct. 1976 32 p refs
(Contract F30602-75-C-0202)
(AD-A033396; R-76-082; RADC-TR-76-328) Avail: NTIS HC A03/MF A01 CSCL 09/5

The report describes the continuing work done to improve the performance of microwave phase shifters based on the concept of electrically controllable liquid artificial dielectrics using metallic suspensions of asymmetric metal particles. Methods for producing permanent, sub-micron metal particle suspensions were experimentally considered including ball milling, mercury cathode reduction and electric arc pulverization. Stable suspensions of spheroidal particles were made in quantity using the electric arc method with a hydrophobic, protective surfactant. However, the objective of making the required highly asymmetric particles in the size range 200-800A was not met. The use of a pair of reset electrodes in the waveguide Ku-band phase shifter demonstrated that reset times can be at least decreased to 1/5 of the rotational relaxation time. GRA

N77-23374# Northeastern Univ., Boston, Mass.
INVESTIGATION AND DESIGN OF ELECTRIC CIRCUITRY RELATED TO NOISE AND RADIATION EFFECTS FOR SOLID STATE DEVICES AND CIRCUITS Interim Report, 1 Nov. 1974 - 31 Oct. 1975
Basil L. Cochrun Jul. 1976 42 p refs
(Contract F19628-74-C-0051)
(AD-A032659; RADC-TR-76-209; IR-2) Avail: NTIS HC A03/MF A01 CSCL 17/5

This report details the design and operation of an infrared detector scanning system. Operation involves detector charging, photon illumination, parallel signal transfer and serial readout using a CCD shift register. It provides six signals in the necessary sequence, magnitude, and phase to drive MOS-FET type loads, variable bias supplies, DVM monitoring, and a digital word generator. Author (GRA)

N77-23375# Naval Training Equipment Center, Orlando, Fla. Electronics and Acoustics Lab.
ELECTRIC CONTROL FOR 360 DEGREE NONPROGRAMMED VISUAL DISPLAY Interim Report, Jan. - Apr. 1976
John J. Kulik and Herbert Berke Nov. 1976 25 p
(AD-A032679; NAVTRAEQUIPC-IH-267) Avail: NTIS HC A02/MF A01 CSCL 20/5

An electronic control system is designed for a 360 degree nonprogrammed visual display. Synchronizing signals for various system components are developed based on an analysis of the system requirements. Discussion of state-of-the-art logic required is given, and detailed circuitry is shown for system implementation. Author (GRA)

N77-23376# United Technologies Research Center, East Hartford, Conn.
IMPROVEMENT OF ELECTRONICS RELIABILITY BY RF SPUTTERING TECHNIQUES Final Report, 1 May 1975 - 1 May 1976
D. H. Grantham and J. L. Swindal May 1976 129 p
(Contract N00019-75-C-0465)
(AD-A032441; UTRC/R76-922139-4) Avail: NTIS HC A07/MF A01 CSCL 20/12

Electromigration in RF sputtered films of aluminum-copper alloys was documented. Copper content was 1 percent 8 percent and 12 percent nominally. At less than 200 C and current densities of less than 3 million amps/sq cm, the films with 1 percent copper exhibited significantly longer life than the films with higher copper content. Beryllium oxide was sputtered from a BeO target and reactively from a beryllium target. Constitutive stress was reduced until the films deposited on silicon were dominated by thermal stresses. Heat-sinking with gallium proved to be extremely difficult in the presence of the activated oxygen species introduced during sputtering. Films approximately 0.001 inch thick were deposited on GaAs substrates without thermal stress cracking. Columnar growth of the beryllium oxide was observed in all cases. Author (GRA)

N77-23377# Cornell Univ., Ithaca, N.Y.
NOISE LIMITATIONS OF RF SQUIDS
Robert A. Buhrman 5 Oct. 1976 38 p refs
(Contract N00014-76-C-0526)
(AD-A032722; TR-4) Avail: NTIS HC A03/MF A01 CSCL 20/3

In this paper a discussion is given of the noise sources and sensitivity limits of the rf biased SQUID. Both the low critical current inductive and the higher critical current hysteretic devices are considered. The intrinsic SQUID noise is treated by considering the internal flux response of a SQUID ring to an applied rf flux. While approximate, this approach yields the most direct picture of the nature of the intrinsic noise. Circuit optimization procedures for maximizing SQUID performance under various operating conditions are also outlined. Finally the effects of non-ideal weak link behavior upon SQUID operation are treated. Author (GRA)

N77-23378# Drexel Univ., Philadelphia, Pa. Dept. of Electrical Engineering.

DEVELOPMENT OF A MODEL FOR THE ULTRASONIC WIRE BOND USED IN MICROCIRCUIT FABRICATION Final Report
1 Sep. 1976 16 p refs
(Contracts N00163-76-C-0171; N00163-75-C-0029)
(AD-A034015) Avail: NTIS HC A02/MF A01 CSCL 13/8

The primary objective of this contract has been to develop and improve the experimental techniques needed to evaluate the microcircuit bond model. To this end an alternate technique has been developed for separating the bond so that the interface can be examined; techniques and equipment for fabricating substrates have been improved; methods for measuring substrate properties have been developed; techniques for making several thousands of bonds to each substrate have been developed, and methods for controlling ball size and shape have been developed. The techniques and equipments required for a full scale study of the microcircuit bond model are now available. The initial results indicate that the bond model is reasonably consistent with the test results. A full scale study of the bond model is recommended. GRA

N77-23379# General Electric Co., Philadelphia, Pa. Space Div.
EMP SURGE SUPPRESSION DEVICES UTILIZING METAL OXIDE VARISTORS FOR HIGH FREQUENCY APPLICATIONS Final Technical Report, Aug. 1974 - Dec. 1975
Dante M. Tasca, Samuel J. Stokes, III, and John P. Quine Mar. 1976 104 p refs
(Contract DAAG39-75-C-0008)
(AD-A033785; Doc-75SDS-4272; HDL-CR-76-008-1) Avail: NTIS HC A06/MF A01 CSCL 09/5

This report summarizes the analytical and experimental work performed in developing a surge suppression assembly for high frequency applications utilizing metal oxide varistor materials. The goal of this effort was the development of a terminal protection unit for EMP protection whose insertion losses for normal signal conditons do not exceed 1 db for signal frequencies up to 100 MHz. The development of the desired terminal protection unit was investigated using the varistor material in two broad circuit configurations these being distributed parameter and lumped parameter configurations. GRA

N77-23380# GTE Labs., Inc., Waltham, Mass.
HERTZIAN ARRAY SWITCH INVESTIGATION Final Technical Report, 18 Jun. 1975 - Jun. 1976
Joseph M. Proud, Donald H. Baird, and William H. McNeill Griffiss AFB, N. Y. RADC Oct. 1976 52 p refs
(Contract F30602-75-C-0164)
(AD-A033713; RADC-TR-76-301) Avail: NTIS HC A04/MF A01 CSCL 09/5

An investigation of fast, high power switching with jitter in the sub-nanosecond time domain is reported. Methods involving field distortion triggering in high pressure gases, photoconduction triggering in aprotic liquids, and opto-electronic triggering in solid semiconductors have been investigated. The most promising avenue for further research is identified in the latter area where extremely small jitter and rapid turn-on capabilities are well matched to the timing requirements in Hertzian arrays. Author (GRA)

N77-23381# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THERMAL NEUTRON DAMAGE IN BIPOLAR PNP TRANSISTORS M.S. Thesis
Timothy D. Stanley Dec. 1976 88 p refs
(AF Proj. 1132)
(AD-A034881; GNE/PH/76-6) Avail: NTIS HC A05/MF A01 CSCL 09/1

An experimental test was made of the hypothesis that the source of thermal neutron damage in bipolar PNP transistors is the result of thermal neutron captures by the Boron 10 present in the emitter region of the transistors. Transistors were specifically made using three different ratios of Boron 10 to Boron 11 as the emitter dopant material, and in four different geometries. Forty-two of these specially made transistors were exposed to thermal neutron fluences as high as approximately 5 x 10 to the 15th power neutrons per square centimeter. In each case the damage observed corresponded to the fraction of Boron 10 to total boron used as the emitter dopant material, thus confirming the hypothesized damage mechanism. The dependence of the collector current, thermal neutron fluence, and emitter-base geometry on the observed gain degradation also indicated that bulk damage is responsible for thermal neutron damage in PNP transistors. Some devices were also irradiated in a fast neutron environment. Fast neutrons were found to be approximately one hundred times more effective than thermal neutrons in producing damage in the devices that use a naturally occurring ratio of Boron 10 to Boron 11 in the emitter. Author (GRA)

N77-23382# Naval Postgraduate School, Monterey, Calif.
THEORY OF OPERATION AND APPLICATIONS OF SAMPLED ANALOG DEVICES IN RECURSIVE COMB FILTERS Ph.D. Thesis
Stacy Vernon Holmes Jun. 1976 333 p refs
(AD-A033698) Avail: NTIS HC A15/MF A01 CSCL 09/1

The theory of operation of charge coupled devices in the sampled analog mode is investigated. The applications of charge coupled devices in recursive filters is explored, both in first and second order systems. A means for translating nth order filters to first or second order is explained. Tables are developed to assist the engineer in choosing the proper coefficients for second order recursive filter design. Applications of recursive filter systems to moving target indicator processors are explored. GRA

N77-23383# Toledo Univ., Ohio. Dept. of Electrical Engineering.
RESEARCH INITIATION. COMPUTER AIDED TOLERANCE ASSIGNMENT FOR MICROELECTRONIC CIRCUITS Final Report, 1 Apr. 1974 - 31 Mar. 1976
Arthur R. Thorbjornsen Jun. 1976 72 p refs
(Grant NSF ENG-74-10024-A01)
(PB-262802/2; Rept-7612) Avail: NTIS HC A04/MF A01 CSCL 09E

Experiments were designed to test the effect of various factors on the correlation between thick film resistors and on the shape of the probability density function of thick film resistors. An algorithm was developed for computer aided tolerance design in which the circuit element standard deviations and one correlation coefficient are design variables. A method was developed for the computer generation of sets of correlated resistor values which have skewed distributions. GRA

N77-23384# Michigan Univ., Ann Arbor. Electron Physics Lab.
MICROWAVE SOLID-STATE DEVICE AND CIRCUIT STUDIES Final Technical Report, 1 Sep. 1973 - 1 Oct. 1976
N. A. Masnari and R. J. Lomax Griffiss AFB, N. Y. RADC Nov. 1976 162 p refs
(Contract F30602-74-C-0012; AF Proj. 5573)
(AD-A034043; RADC-TR-76-335; Rept-012128-F) Avail: NTIS HC A08/MF A01 CSCL 09/5

This is the Final Technical Report on subject contract whose objectives are to investigate theoretically and experimentally new solid-state phenomena and techniques having application to microwave generation, amplification and control. Tasks under this program are: Properties of IMPATT Diodes, Transverse Effects in IMPATT Devices, Pulsed IMPATT Diodes, Field-Effect Transistors, Experimental Field-Effect Transistor Investigations, IMPATT Diode Amplifiers, Controlled Avalanche Transit Time (CATT) Devices. Author (GRA)

N77-23385 Massachusetts Univ., Amherst.
TIME-DEPENDENT CARRIER FLOW IN A POWER TRANSISTOR STRUCTURE UNDER NONISOTHERMAL CONDITIONS Ph.D. Thesis
Vinson Chester Alwin 1976 113 p
Avail: Univ. Microfilms Order No. 77-6436

A two-dimensional mathematical model is developed to predict the internal behavior of power transistors under transient operating conditions. The complete set of time-dependent equations governing the bipolar semiconductor transport of mobile carriers and heat flow within a transistor structure is solved by numerical techniques without assuming internal junctions and other conventional approximations. The set of partial differential equations which describe carrier transport and heat flow in a

bipolar semiconductor device are approximated, temporally and spatially, by the finite difference technique. The computed results of the time-dependent analysis for a typical NPN power transistor under two operating conditions is presented, demonstrating the electrothermal interaction in this specific device. Dissert Abstr.

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N77-23386 California Univ., San Diego.
STUDIES IN THE FLUID DYNAMICS OF RADIATING BLAST WAVES AND STAGNATION COUNTERFLOWS Ph.D. Thesis
Gary George Erickson 1976 120 p
Avail: Univ. Microfilms Order No. 77-4207

Analytical and numerical calculations are carried out for an initially adiabatic blast wave in which the effect of gas radiation increases as the temperature decreases. For a specific heat ratio gamma near unity the shock velocity will remain near the adiabatic value, whereas for gamma = 5/3 the shock velocity will approach the value for a momentum-conserving shell, as predicted. An initial-value analysis using integral transform used to obtain a linear calculation of the growth and decay of perturbations at an interface in a stagnation counterflow is discussed. A feasibility experiment which demonstrates that gas-gas interfaces can be observed in a stagnation counterflow is described. Photographs of typical interfaces are presented, and possible instability behavior is discussed. Dissert. Abstr.

N77-23387 California Univ., Berkeley.
SOME TWO AND ONE-DIMENSIONAL PROBLEMS IN FLUID MECHANICS BY A DIRECT APPROACH Ph.D. Thesis
David Allen Caulk 1976 152 p
Avail: Univ. Microfilms Order No. 77-4406

In the context of a direct two-dimensional theory of a fluid sheet based upon a model called a Cosserat surface, an exact solution is obtained for the flow of an inviscid incompressible fluid under a sluice gate. Also, a direct one-dimensional theory based upon a model called a Cosserat curve is used to describe the flow of a straight incompressible fluid jet; the jet is of elliptical cross-section and is allowed to twist along its axis. The latter development leads to some new solutions for an inviscid jet, and the theory is applied to the problem of instability of inviscid and viscous jets in the presence of surface tension.
Dissert. Abstr.

N77-23388 Washington Univ., Seattle.
AN EQUATION FOR NONLINEAR WAVE PROPAGATION IN THERMO-VISCOUS FLUIDS WITH AN APPLICATION TO PISTON-DRIVEN FLOW Ph.D. Thesis
Richard Carl Mayer 1976 117 p
Avail: Univ. Microfilms Order No. 77-4311

A single equation for two and three dimensional potential flow in a viscous, heat-conducting fluid is derived. An ordinary differential equation is obtained by group-theoretic methods and is applied to the problem of fluid flow ahead of a cylindrically or spherically symmetric piston, with the piston radius proportional to the square root of the time. A closed form solution is obtained for the cylindrical case when the effect of the initial equilibrium pressure is neglected. A solution in series form which takes into account the initial pressure is also obtained. Corresponding numerical solutions for the case of spherical symmetry are presented. While direct numerical integration of the equation for the spherical piston is quite difficult, the cylindrical solution can be used as a first approximation. Further approximations are then obtained by a rapidly converging iterative scheme involving numerical integration of only a first order equation.
Dissert. Abstr.

N77-23389 Oklahoma State Univ., Stillwater.
IRREGULAR TRANSFORMATION GROUPS ON COMPACT POLYHEDRA Ph.D. Thesis
Ki Woong Kim 1976 43 p
Avail: Univ. Microfilms Order No. 77-5120

Irregularities of discrete flows and continuous flows with compact polyhedra as phase spaces were studied. A compact polyhedron supports an irregular flow, either discrete or continuous, if and only if it has no principal 1-cells. Projections and lifts of uniformly irregular homeomorphisms via covering maps are uniformly irregular. Finally, characterizations of uniformly irregular homeomorphisms and expansive homeomorphisms are given.
Dissert. Abstr.

N77-23390 California Univ., Berkeley.
CROSS SECTIONS TO FLOWS Ph.D. Thesis
David Shane Fried 1976 53 p
Avail: Univ. Microfilms Order No. 77-4459

A geometric criterion for the existence and classification of cross sections to smooth flows on a compact manifold is described. Some new invariants, the homology directions of a flow, are defined from the geometric properties of the flowlines. Given a flow and an indivisible class in first cohomology, there is an associated cross section if and only if the class is positive on the homology directions of the flow. This gives an effective procedure for deducing the existence of a cross section to an Axiom A flow from a Markov family of local sections on the nonwandering set. Some results are obtained on what sets of homology directions may appear among the various flows on a given manifold. The criterion for the existence of cross sections is applied to the fibering of manifolds over a circle and to Anosov diffeomorphisms. Dissert. Abstr.

N77-23391 Wisconsin Univ., Madison.
WAVE PROPAGATION IN A ROTATING FLUID OF SPHERICAL CONFIGURATION Ph.D. Thesis
Steven David London 1976 205 p
Avail: Univ. Microfilms Order No. 76-28156

The general, time-dependent problem of wave propagation in an incompressible, inviscid fluid contained in a rotating shell of variable thickness is studied by means of the ray method. The approximation obtained is applied to the time-reduced case to study free oscillations in a rotating spherical shell. Axisymmetric modes covering the whole sphere and asymmetric modes trapped in equatorial regions bounded by critical circles of constant latitude as well as in regions off the equator bounded by caustics are discovered. The anomalies at poles and critical circles of the ray method expansion are removed by means of uniform asymptotic expansions. Equations for the resonant frequencies are found and the phase shifts at critical circles and poles are discovered.
Dissert. Abstr.

N77-23392 Arizona State Univ., Tempe.
SECONDARY VELOCITY EFFECTS ON OXYGEN TRANSFER TO FLUIDS FLOWING IN HELICAL PERMEABLE TUBES Ph.D. Thesis
Harlow Byron Christianson 1976 218 p
Avail: Univ. Microfilms Order No. 77-5572

The transition from straight to coiled flow and the approach to the wall limited behavior was theoretically and experimentally investigated. Approximate analytical solutions were obtained for the above conditions, and experimental blood oxygenation data were taken to compare with the theoretical predictions. A limited number of water oxygenation data were obtained to provide non reactive transfer comparisons. Dissert. Abstr.

N77-23393 California Univ., Berkeley.
RADIONUCLIDE IMAGING WITH CODED APERTURES AND THREE-DIMENSIONAL IMAGE RECONSTRUCTION FROM FOCAL-PLANE TOMOGRAPHY Ph.D. Thesis
Lee-Tzuu Chang 1976 187 p
Avail: Univ. Microfilms Order No. 77-4409

Two techniques for radionuclide imaging and reconstruction were studied; both are used for improvement of depth resolution. The first technique is called coded aperture imaging, which is a technique of tomographic imaging. The results show that a non-redundant pinhole coded aperture can provide a simple and reliable way to obtain the images of a 3-D object with adequate

depth resolutions and low background artifacts. The second technique is a special 3-D image reconstruction method which is an improvement to the so called focal-plane tomography.
Dissert. Abstr.

N77-23394 California Univ., Berkeley.
HEAT TRANSFER IN INTERNAL FLOWS INCLUDING BUOYANCY AND THERMAL RADIATION Ph.D. Thesis
Terrence Edwin Donovan 1976 196 p
Avail: Univ. Microfilms Order No. 77-4438

The turbulent and laminar flow of radiating and non-radiating gases in a circular tube were analyzed. Turbulent flow of a transparent gas in a cylinder was studied experimentally and analytically. The laminar flow of a radiating gas in a vertical tube with appreciable buoyancy effects was examined. The laminar flow of a transparent gas in a vertical tube including the effect of buoyancy was also studied. Dissert. Abstr.

N77-23395 Connecticut Univ., Storrs.
EFFECT OF LATERAL INFLOW ON STEADY OPEN CHANNEL FLOWS Ph.D. Thesis
Hsiang Kuei Soong 1976 122 p
Avail: Univ. Microfilms Order No. 77-4298

The energy loss in the junction, and the momentum and energy balance in the nonuniform region in an open channel due to the effect of the lateral inflow were studied. By a critical examination of one-dimensional open channel flow analysis, it was shown that a single momentum or energy equation as widely used in the past is not sufficient to explain certain anomalies in the nonuniform flow region. The streamwise variation of momentum and energy correction factors that are determined from the two methods discussed above is shown to be a pertinent parameter for the nonuniform flow field. Dissert. Abstr.

N77-23396 California Univ., Berkeley.
HEAT AND MASS TRANSFER OF MULTI-SPRAY UNIT COOLING SYSTEM IN OPEN ATMOSPHERE Ph.D. Thesis
Kim Hong Chen 1976 170 p
Avail: Univ. Microfilms Order No. 77-4413

A fundamental yet computationally convenient method of predicting the open atmosphere spray system performance is developed through the introduction of the SER (Spray Energy Release) concept for a spray unit. The SER for a spray unit is experimentally determined and correlated as a function of wind speed. The SER approach predicts the cooling of the whole spray unit and avoids the detailed consideration of the heat and mass transfer of each individual drop. The present study concurrently considers the wind attenuation effect in the spray field. The amount of cooling a spray unit can achieve at any location in the spray field depends on the local air wet-bulb temperature and the wind speed only. The experimentally correlated SER function enables one to determine the local air wet-bulb temperature while the consideration of wind attenuation through the spray field enables one to determine the local wind condition. The model was experimentally verified by using the test results of two different spray pond systems. Dissert. Abstr.

N77-23397 Oklahoma State Univ., Stillwater.
STATIC AND DYNAMIC ANALYSES OF VORTEX RESISTORS Ph.D. Thesis
Syed Hamid 1976 154 p
Avail: Univ. Microfilms Order No. 77-5087

Empirical models were developed for symmetric and nonsymmetric vortex resistors. The empirical models can be used to predict the flow rate through the resistor for a given pressure drop across the resistor within 30 percent of the measured value. Two steady-state analytical models, one incorporating a one-dimensional and the other a two-dimensional approximation to the flow field in the vortex chamber, were developed for the nonsymmetric vortex resistor. A one-dimensional model was developed for the symmetric vortex resistor. These models exhibit a maximum error of 15 percent of the measured value. It was established that (1) temperature-insensitive vortex resistors can be built in practical sizes, (2) vortex resistors can be designed to compensate for the positive temperature sensitivity of capillary tube and orifice type fluid resistors, and (3) vortex resistors (operating on hydraulic oil) behave primarily as resistors with no appreciable reactive dynamics. Dissert. Abstr.

N77-23398 Oklahoma State Univ., Stillwater.
THE EVALUATION OF CIRCUIT MODELS OF LUMPED PASSIVE FLUIDIC COMPONENTS Ph.D. Thesis
Joseph Morton Iseman 1976 124 p
Avail: Univ. Microfilms Order No. 77-5104

A quantitative procedure is developed in the form of an evaluation algorithm for selecting a best equivalent circuit model which is based upon a validated reference model and a user-chosen cost or penalty function. Two existing circuit analysis programs (NET-2) and (SLIC) were adapted for use in the simulation of passive fluidic systems. Component models for three fluidic components (capillary modules, tanks, and bellows modules) are formulated and evaluated in several fluidic configurations. A general approach to the analytical design of passive fluidic systems is briefly discussed. An evaluation algorithm is demonstrated which has both qualitative and quantitative significance for assessing the validity of sets of equivalent circuit models of passive fluidic components with respect to a reference model. It is concluded that a best model must be somewhat subjective because of constraints on the set of models, on the reference model, on the test conditions, and on the error criteria.
Dissert. Abstr.

N77-23399 California Univ., Berkeley.
HEAT TRANSFER IN MICROSPHERE THERMAL INSULATIONS Ph.D. Thesis
Ashok Laxminarayan Nayak 1976 114 p
Avail: Univ. Microfilms Order No. 77-4553

An extensive analytical and experimental study on heat transport in aluminized and clear hollow glass microspheres is presented. These microspheres are first investigated for their particle size distribution, shell thickness, surface and volume texture, and composition. The size distribution, based on a statistical sampling using a Zeiss Counter, is described by logarithmic normal probability distribution functions. Values of the effective conductivity of the fully aluminized and also the clear glass microspheres were obtained from 80 to 300 K from the steady-state experiments. The effective thermal diffusivity of the coated microspheres is also found based on the transient data. The conductivity data are analyzed for the effects of the sample size, the microsphere surface texture, and the thermal strain loading. These parameters are found to have considerable influence on the lattice conductivity values for both types of microspheres. Comparison between the experimental results and the theoretical predictions is also presented. Dissert Abstr.

N77-23400 Oklahoma State Univ., Stillwater.
CRITICAL REGION BEHAVIOR AND EFFECT OF PRESSURE ON LIQUID VISCOSITY Ph.D. Thesis
David Duane McCoy 1976 203 p
Avail: Univ. Microfilms Order No. 77-5134

Two existing viscometers were used to measure viscosities of various liquids. An absolute capillary instrument was used to measure the critical region viscosity of ethanol, n-propanol and n-octane. This apparatus was also used to determine the effect of back pressure on the viscosity of n-octane and n-octanol. A relative apparatus was used, employing a Zeitfuchs cross-arm capillary viscometer, to obtain kinematic viscosities of n-octane and n-octanol under gas blankets. The blanket gases used were argon, helium, hydrogen, methane, and nitrogen. Dissert. Abstr.

N77-23401 Oklahoma State Univ., Stillwater.
THE FILM BOILING OF DROPS UNDER PRESSURE Ph.D. Thesis
Thomas Robert Rhodes 1976 206 p
Avail: Univ. Microfilms Order No. 77-5171

The film boiling of Freon-114 drops up to the critical pressure and water drops at atmospheric pressure was studied experimentally and analytically. The experimental portion of this study consisted of photographic determination of drop diameter histories and lifetime curves. The Leidenfrost Point was determined for each fluid. The model was used to predict the effect of pressure on the drop diameter history and lifetime.
Dissert. Abstr.

N77-23402 Massachusetts Univ., Amherst.
RESPONSE OF PARTIALLY FILLED ELASTIC CYLINDRICAL STORAGE TANK SUBJECTED TO ARBITRARY LATERAL

BASE EXCITATION Ph.D. Thesis
Timoleon Mouzakis 1976 161 p
Avail: Univ. Mircofilms Order No. 77-6422

An analytic solution is presented for a large ground supported storage tank subjected to arbitrary lateral base excitation. A computer program is developed to obtain the exact solution for the forced vibration of a partially filled, elastic, cylindrical tank with any type of boundary conditions. The Fleugge equations were employed for the elastic shell, and the Laplacian equation is used to govern the motion of the inviscid, irrotational liquid in the tank. The natural frequencies and the corresponding mode shapes of an empty cylindrical tank and the natural frequencies and mode shapes of the partially filled storage tank are presented. The modal superposition technique is employed to determine the response of the storage tank to arbitrary lateral excitation of the slab supporting the tank. Dissert. Abstr.

N77-23403 California Univ., Berkeley.
FINITE ELEMENT ANALYSIS OF NONLINEAR HEAT TRANSFER PROBLEMS Ph.D. Thesis
Ronald Milos Polivka 1976 193 p
Avail: Univ. Microfilms Order No. 77-4574

A finite element formulation is developed for the analysis of two-dimensional linear and nonlinear heat transfer problems. Several important boundary conditions are incorporated into the analysis including those of specified nodal temperature and heat flux, convection, radiation, and cooling pipes. The time-dependent rate of internal heat generation within any element is also considered. The matrix equation for heat flow equilibrium is solved using a step-by-step integration scheme which assumes a linear variation of the temperature over any time step. Based on this work, two computer programs were developed for the heat transfer analysis of structures. The numerical results for a number of sample analyses are presented which demonstrate the capability and accuracy of the two programs. Dissert. Abstr.

N77-23404 California Univ., Berkeley.
THERMAL CONDUCTIVITY OF MULTI-FLUID SATURATED POROUS MEDIA Ph.D. Thesis
Hueseyin Oezbek 1976 113 p
Avail: Univ. Microfilms Order No. 77-4563

A conceptual model was developed for prediction of thermal conductivity of multifluid saturated porous media. Predictions by the model were found to be in good agreement with experimentally measured thermal conductivities of Ottawa sand, Boise, Bandera, and Berea sandstones. The model was used for studying the sensitivity of thermal conductivity to the several parameters involved. The analysis indicates that the thermal conductivity depends primarily on porosity, thermal conductivity of rock solids, and wetting fluid saturation. Data were generated using the model equations to develop a correlation equation by regression analysis. The correlation equation can be used for rapid predictions of thermal conductivity of multifluid saturated porous media. A method was developed for study of thermal resistance at solid-stagnant liquid interfaces. The analysis together with the model equations indicate that solid-stagnant liquid contact resistivities are of negligible importance in thermal conductivity predictions. Dissert. Abstr.

N77-23405*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Systems Engineering and Analysis Dept.
HP-9825A CALCULATOR PROGRAMS FOR PLOTTING ORBITER RCS JET DYNAMIC PRESSURE CONTOURS
S. W. Wilson 16 Mar. 1977 39 p refs
(Contract NAS9-14723)
(NASA-CR-151335; TRW-28415-H004-R0-00) Avail: NTIS HC A03/MF A01 CSCL 20D

Computer programs which generate displays of the dynamic pressure fields generated by orbiter RCS thruster firings are described. The programs can be used to generate dynamic contours for an isolated RCS jet and to superimpose the plume contours for specific jets or jet clusters on front and side views of the orbiter profile. Author

N77-23406*# Lockheed Electronics Co., Houston, Tex.
DYNAMIC PRESSURE STUDIES
J. W. Hall Mar. 1977 10 p
(Contract NAS9-15200)
(NASA-CR-151356; ISC-12603; LEC-10264) Avail: NTIS HC A02/MF A01 CSCL 20D

The effects on dynamic pressure by errors in viscous interaction of air, navigation filter errors, and wind errors were investigated. Results are summarized in tabular from. Author

N77-23407*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VARIATIONAL ENERGY PRINCIPLE FOR COMPRESSIBLE, BAROCLINIC FLOW. 1: FIRST AND SECOND VARIATIONS OF TOTAL KINETIC ACTION
Lawrence A. Schmid Apr. 1977 78 p refs Submitted for publication
(NASA-TM-X-71311; X-602-77-97) Avail: NTIS HC A05/MF A01 CSCL 20D

The case of a cold gas in the absence of external force fields is considered. Since the only energy involved is kinetic energy, the total kinetic action (i.e., the space-time integral of the kinetic energy density) should serve as the total free-energy functional in this case, and as such should be a local minimum for all possible fluctuations about stable flow. This conjecture is tested by calculating explicit, manifestly covariant expressions for the first and second variations of the total kinetic action in the context of Lagrangian kinematics. The general question of the correlation between physical stability and the convexity of any action integral that can be interpreted as the total free-energy functional of the flow is discussed and illustrated for the cases of rectillinear and rotating shearing flows. Author

N77-23408*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTERACTIVE CALCULATION PROCEDURE FOR SUPERSONIC FLOWS Ph.D. Thesis - Case Western Reserve Univ., 1976. Final Report
Yehuda Tassa (Case Western Reserve Univ.), Bernhard H. Anderson, and Eli Reshotko (Case Western Reserve Univ.) May 1977 170 p refs
(Grant NGR-36-027-064)
(NASA-TM-X-73653; FTAS/TR-76-125) Avail: NTIS HC A08/MF A01 CSCL 20D

An interactive procedure was developed for supersonic viscous flows that can be used for either two-dimensional or axisymmetric configurations. The procedure is directed to supersonic internal flows as well as those supersonic external flows that require consideration of mutual interaction between the outer flow and the boundary layer flow. The flow field is divided into two regions: an inner region which is highly viscous and mostly subsonic and an outer region where the flow is supersonic and in which viscous effects are small but not negligible. For the outer region a numerical solution is obtained by applying the method of characteristics to a system of equations which includes viscous and conduction transport terms only normal to the streamlines. The inner region is treated by a system of equations of the boundary layer type that includes higher order effects such as longitudinal and transverse curvature and normal pressure gradients. These equations are coupled and solved simultaneously in the physical coordinates by using an implicit finite difference scheme. This system can also be used to calculate laminar and turbulent boundary layers using a scalar eddy viscosity concept. Author

N77-23409# Air Force Academy, Colo.
THERMAL RADIATION EFFECTS ON A NORMAL SHOCK WAVE INCIDENT TO A PLANE WALL
Michael Lynn Smith 11 Jun. 1976 34 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Aug. 1977
Avail: NTIS HC A03/MF A01

The effects of low intensity thermal radiation on the propagation of a normal shock wave incident to a plane, grey, radiating wall were investigated. The shock is treated as a discontinuity embedded in a structure due to radiation, and the effects of self absorption and emission in the gas on both sides of the shock are included. A first order method of characteristics solution about the initial profile is analytically obtained for the velocity, temperature, pressure, density, radiation heat flux, and shock propagation speed by assuming that all variables can be expressed in power series expansions of the reciprocal of the

Boltzmann number. The flow field perturbations for the incident shock are shown to be of the same order as those for the reflected shock. Author

N77-23410# Lincoln Lab., Mass. Inst. of Tech., Lexington. Electromechanical Systems Engineering Group.
PREDICTION OF SURFACE PRESSURES DURING WATER IMPACT
A. B. Wardlaw, Jr. (Naval Surface Weapons Lab., White Oak, Md.) and P. M. Aronson (Naval Surface Weapons Lab., White Oak, Md.) 17 Jan. 1977 33 p refs Backup document for AIAA Synoptic Scheduled for publication in Journal of Hydronautics in Jul. 1977 Sponsored by Navy
Avail: NTIS HC A03/MF A01

A potential flow model was developed to predict pressures and loads during the oblique water impact of axisymmetric bodies. The free surface is replaced by an effective planar surface which is positioned using experimental information. At each depth, the flow field solution is determined using a distribution of sources on the model surface. Pressures, calculated by Bernoulli's equation, are integrated to produce total model loads. Experimental pressure measurements are made on obliquely entering disk and ogive cylinders and results are corrected to reflect the finite size of the pressure gage. Calculations are compared to these and other experimental data for the oblique entry of spheres, disk and ogive cylinders and for the vertical entry of cones and spheres. Surface pressures agree well with experiment reflecting both the model geometry and location on the model. The calculated drag also compares closely to measurement, particularly prior to the drag peak. Author

N77-23411*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASTRAN THERMAL ANALYZER: THEORY AND APPLICATION INCLUDING A GUIDE TO MODELING ENGINEERING PROBLEMS, VOLUME 1
Hwa-Ping Lee Washington Apr. 1977 250 p refs 2 Vol.
(NASA-TM-X-3503) Avail: NTIS HC A11/MF A01 CSCL 20D

The NASTRAN Thermal Analyzer Manual describes the fundamental and theoretical treatment of the finite element method, with emphasis on the derivations of the constituent matrices of different elements and solution algorithms. Necessary information and data relating to the practical applications of engineering modeling are included. Author

N77-23412*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASTRAN THERMAL ANALYZER: THEORY AND APPLICATION INCLUDING A GUIDE TO MODELING ENGINEERING PROBLEMS, VOLUME 2
Clifton E. Jackson, Jr. Washington Apr. 1977 551 p 2 Vol.
(NASA-TM-X-3504) Avail: NTIS HC A24/MF A01 CSCL 20D

A sample problem library containing 20 problems covering most facets of Nastran Thermal Analyzer modeling is presented. Areas discussed include radiative interchange, arbitrary nonlinear loads, transient temperature and steady-state structural plots, temperature-dependent conductivities, simulated multi-layer insulation, and constraint techniques. The use of the major control options and important DMAP alters is demonstrated. Author

N77-23413# California Univ., Berkeley. Lawrence Berkeley Lab.
SUFFICIENT CONDITIONS FOR STABILITY OF AXISYMMETRIC ANNULAR LIQUID INTERFACES
I. Karasalo Jun. 1976 36 p refs
(Contract W-7405-eng-48)
(LBL-4898) Avail: NTIS HC A03/MF A01

The stability, in terms of minimum static energy, of axisymmetric annular liquid interfaces in axisymmetric containers is studied mathematically. The sufficiency of stability conditions based on the Jacobi accessory minimization problem with respect to volume conserving, weak perturbations is proved in two cases. Sufficient conditions for stability in the general case of non-zero liquid-wall contact angle are considered. The formal limit of these conditions, as the contact angle tends to zero, is proved to be correct, provided that the curvatures of the unperturbed liquid-vapor interface and the container wall are not equal at their contact lines. ERA

N77-23414# Argonne National Lab., Ill. Components Technology Div.
USER'S MANUAL FOR EVITS: A STEADY STATE FLUIDS CODE FOR COMPLEX TWO-DIMENSIONAL GEOMETRICS
H. M. Domanus Jul. 1976 150 p refs
(Contract W-31-109-ENG-38)
(ANL-CT-76-37) Avail: NTIS HC A07/MF A01

A 2-D computer code, EVITS, was developed for estimating steady state, imcompressible, isothermal flow fields in complex geometries. A vorticity-stream function formulation is used along with a model to resolve viscous effects at solid boundaries. Sufficient geometry and boundary type options are included within the code so that a large number of flow situations can be specified without modifying the program. All instructions to the code are via an input dataset. Detailed instructions for preparing the user oriented input, along with examples, are included in this users' manual. ERA

N77-23415# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
DEGRADATION OF THERMAL CONTROL COATINGS BY ULTRAVIOLET AND PARTICLE IRRADIATION Final Report [DEGRADATION DE REVETEMENTS DE CONTROLE THERMIQUE PAR IRRADIATIONS ULTRAVIOLETTES ET PARTICULAIRES]
A. Paillous Oct. 1976 203 p refs In FRENCH Report will also be announced as translation (ESA-TT-388)
(Contract ESTEC-2558/75-JS)
(ESA-CR(P)-913) Avail: NTIS HC A10/MF A01

The degradation of the solar reflection factor was investigated for 10 types of thermal coatings during a simulated 3 year exposure to the space environment of the geosynchronous OTS satellite. The irradiations and measurements were carried out under secondary vacuum conditions at 90 C. A simultaneous exposure to ultraviolet radiation, to 200 keV electrons, and to 40 keV and 150 keV protons was realized. The materials tested were indium oxide conductive coatings, French and American zinc oxide white paints, and conductive black paints. The electrical resistance of the samples was recorded as a function of time. ESA

N77-23416# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
STATIC PRESSURE PROFILES FOR TURBULENT BOUNDARY LAYERS ON THE WALLS OF CONTOURED HYPERSONIC NOZZLES
P. J. Finley Jan. 1977 9 p refs Sponsored in part by Deut. Forschungsgemeinschaft and Tech. Univ. Berlin
(IC-Aero-77-01; ISSN-0308-7247) Avail: NTIS HC A02/MF A01

The available experimental static pressure profiles in turbulent boundary layers on the walls of contoured hypersonic nozzles, together with the specific momentum flux profiles, were analyzed to give an estimate of the Reynolds stress contribution to the total normal stress profile. At M approximately 20 the Reynolds stress and the static pressure may be of the same order. Author (ESA)

N77-23417# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Angewandte Gasdynamik.
BASIC EQUATIONS FOR NON-REACTING NEWTONIAN FLUIDS IN CURVILINEAR, NON-ORTHOGONAL, AND ACCELERATED COORDINATE SYSTEMS
Klaus Robert and Roger Grundmann 3 Sep. 1976 43 p refs
(DLR-FB-76-47) Avail: NTIS HC A03/MF A01 DFVR, Cologne DM 17.80

Procedures for writing the basic fluid mechanical equations for a Newtonian fluid relative to a non-inertial reference frame of general non-orthogonal and curvilinear coordinates are reported. The constitutive equations are also discussed and refer to a compressible Newtonian fluid. A survey of non-Cartesian tensor analysis is provided. The flow distribution around finite cambered swept wings is discussed. ESA

N77-23418# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Dept.
GEOS ABM BLANKET AND UPPER HEAT SHIELD DETAIL TEST REPORTS AND PERFORMANCE ANALYSIS
R. Hamann 12 Mar. 1975 39 p refs
(FOK-RV-75-16) Avail: NTIS HC A03/MF A01

Results of tests carried out on the GEOS Apogee Boost Motors (ABM) blanket and upper thermal shield are presented. Based on the test data, the blanket properties were evaluated in order to assess the design adequacy of the upper thermal shield to withstand a 10 kW/sq m heat flux from the ABM plume during ABM firing and the subsequent soak back due to this plume heating and the ABM nozzle temperature. ESA

N77-23419# Joint Technical Coordinating Group for Aircraft Survivability.
FLUID DYNAMIC ANALYSIS OF HYDRAULIC RAM 3 (RESULT OF ANALYSIS) Final Report, Jul. 1972 - Dec. 1974
E. A. Lundstrom and W. K. Fung Sep. 1976 143 p
(AD-A031644; JTCG/AS-74-T-015) Avail: NTIS HC A07/MF A01 CSCL 19/1

This report presents an analysis of the test results of pressure waves generated by a penetrating projectile in fluid and verifies a theory modeling the pressure waves. The method of data reduction and verification also is presented. Author (GRA)

N77-23420# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
STUDIES OF TRANSVERSE LIQUID FUEL JETS IN HIGH-SPEED AIR STREAMS Interim Report
J. Schetz, W. McVey, A. Padhye, and F. Munteanu Jul. 1976 139 p refs Sponsored in part by NSF
(Grant AF-AFOSR-2584-74; AF Proj. 9711)
(AD-A032817; VPI-Aero-049; AFOSR-76-1168TR) Avail: NTIS HC A07/MF A01 CSCL 21/5

This report is in two parts describing two related studies of liquid fuel jet injection. The first study was concerned with the flowfield in the immediate vicinity of the injection port for the case of a hot, supersonic main air stream. Water, kerosene, and carbon disulphide were studied as the injectants. The second study dealt with the details of penetration and break-up of liquid jets in high subsonic speed air streams. Author (GRA)

N77-23421# Calspan Corp., Buffalo, N.Y.
RELAXATION SOLUTIONS FOR THREE-DIMENSIONAL TRANSONIC FLOW THROUGH A COMPRESSOR BLADE ROW, IN THE NONLINEAR SMALL-DISTURBANCE APPROXIMATION Interim Report
William J. Rae Aug. 1976 55 p refs
(Contract F44620-74-C-0059; AF Proj. 9781)
(AD-A032553; AFOSR-76-1081TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

A relaxation method for calculating the three-dimensional transonic flow through a compressor blade row is described. The flow is taken to be steady in blade-fixed coordinates, and is treated in the nonlinear small-disturbance approximation. Details of the finite-difference formulation and the solution procedure are given. The resulting computer code is capable of operating in either of two modes. In the first, the user specifies the complete blade shape and the operating conditions, and the program finds the complete flow field, including the loading distribution on the blades. In the second, the user specifies the loading distribution over the blade surface, and the thickness distribution of the blades. The program then finds the three-dimensional flow field, including the shape of the camber surface about which the prescribed thickness must be symmetrically distributed, in order to produce the prescribed loading. Results of demonstration calculations illustrating each of these modes are included.
Author (GRA)

N77-23422# Naval Academy, Annapolis, Md.
CYCLIC LIQUID JET BEHAVIOR IN PULSATING BUBBLES
Nicholas E. Karangelen 17 May 1976 99 p refs
(AD-A032717; USNA-TSPR-79) Avail: NTIS HC A05/MF A01 CSCL 20/4

The report concerns the behavior of cyclic liquid jets in pulsating bubbles. The jets were developed in bubbles which were situated on a vibrating platform that was contained within a vessel capable of sustaining reduced pressures. The entire assembly was mounted on a variable frequency vibration table and driven at displacement amplitudes on the order of a millimeter. The reduced pressure enabled the jets to be quite easily formed within the vessel; the jets were formed in bubbles containing both vapor and gas, thus resulting in bubbles exhibiting jet behavior over several cycles. The bubbles were photographed with a high speed camera and a detailed analysis made of the behavior of the jet as a function of time. It was found that the bubble surface could be well represented by the first four even terms of a Legendre polynomial expansion. Further, a graphic three-dimensional display of the bubble surface, generated by the expansion, gives excellent agreement with the observed behavior. GRA

N77-23423# Sydney Univ. (Australia). Dept. of Aeronautical Engineering.
NUMERICAL STUDIES IN GAS DYNAMICS Final Scientific Report, 15 Apr. 1972 - 14 Oct. 1976
G. A. Bird 14 Oct. 1976 7 p refs
(Grant AF-AFOSR-2336-72; AF Proj. 9783)
(AD-A033057; AFSOR-76-1178TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

A survey is made of the overall development of the direct simulation Monte Carlo method. This is a method for the computation of gas flows at the molecular level. The major advances have related to the extension of the method to cover some continuum flows, small disturbance flows, and reacting gas flows. All these require very extensive computation and dedicated minicomputers have been shown to be one or two orders of magnitude more cost-effective than large general purpose machines in conventional computer centers. GRA

N77-23424# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
NUMERICAL SOLUTION OF THE COMPRESSIBLE BOUNDARY LAYER EQUATIONS OVER AXISYMMETRIC SURFACES M.S. Thesis
Charles R. Blake Dec. 1976 121 p refs
(AD-A034943; GA/MC/76D-4) Avail: NTIS HC A06/MF A01 CSCL 20/4

A numerical solution of the compressible boundary layer equations was developed for flows over either two-dimensional or axisymmetric surfaces. The solution method is capable of solving for boundary layer parameters in either laminar or turbulent flows. In the case of turbulent flow, closure is achieved by use of a two-layered eddy viscosity model. The boundary layer equations are solved by a numerical marching procedure. A Mangler-Levy-Lees transformation of independent variables is used to improve the efficiency of the numerical solution. The transformed boundary layer equations are then linearized by a three point finite difference scheme. The linearized equations are solved by a matrix solution technique. Comparisons of computed boundary layer parameters with experimentally determined parameters were made for both laminar and turbulent flows over axisymmetric bodies. The comparisons show the numerical solution to be very accurate. Author (GRA)

N77-23425# Colorado State Univ., Fort Collins. Hydro Machinery Lab.
POLYMER INJECTION INTO A DEVELOPING BOUNDARY LAYER Final Report, 1 Oct. 1974 - 31 Mar. 1976
J. Paul Tullis, Michael Poreh, and John A. Hooper Mar. 1976 29 p refs
(Contract N00014-75-C-0274)
(AD-A034901; HM-71) Avail: NTIS HC A03/MF A01 CSCL 20/4

This report describes the last phase of a study on the drag reduction at the entrance region of a 12-inch pipe by injection of polymer solutions. In this phase of the study, the effect of injecting concentrated solutions of WSR 301, up to 3600 ppmw, was examined. This study indicates that the local friction downstream from the injector can be considerably reduced by increasing the discharge of the polymer injected into the pipe. However, the injection disturbs the flow and increases the pressure losses across the injector. When the total drag reduction of a given pipe length (X/D), which includes the losses due to the

injection, is considered, it is found that different optimal conditions exist for reducing the drag of short pipe sections and for reducing the drag of long pipe sections. This report also summarizes a study of drag reduction in a pipe flow of Calgon TRO-375 solutions. For certain tests, this polymer caused an apparent increase in the effective roughness of the pipe walls. In addition, the report summarizes a study of the effect of a polymer (WSR 301) on the cavitation characteristics of a pipe orifice. Author (GRA)

N77-23426# General Dynamics/Convair, San Diego, Calif.
SECOND SURFACE THERMAL CONTROL MIRRORS FOR REFLECTION CONTROL, VOLUME 1 Final Technical Report, Mar. 1974 - Mar. 1975
J. T. Neu and M. F. Dorian 10 Jan. 1977 68 p refs
(Contract F04701-74-C-0318)
(AD-A034863; SAMSO-TR-76-92-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 22/2

This final report documents the results of a theoretical and experimental program to investigate ways to make second surface mirrors (e.g., thermal control surfaces, composed of thin transparent materials such as fused silica and FEP Teflon with a reflective backing, which are used on space vehicles) which are diffusely reflective but which retain the high solar reflectance of commercial specularly reflecting second surface mirrors. A number of designs were surveyed and four designs were fully evaluated. Three of these designs employed fused silica substrates with front or front and back surfaces ground with grinding compounds and then etched in a hydrogen fluoride solution. When suitably silvered on the back sides, these specimens met design goals. One of these designs employed a FEP Teflon substrate with front and back surfaces contoured by compression of Teflon sheet between quartz plates in a vacuum oven. When silvered on the back side, good diffuseness was obtained but solar reflectance was slightly degraded over the reflectance of commercial Teflon second surface mirrors. Author (GRA)

N77-23427# General Dynamics/Convair, San Diego, Calif.
SECOND SURFACE THERMAL CONTROL MIRRORS FOR REFLECTION CONTROL. VOLUME 2: ANNEXES I THRU X Final Technical Report, Mar. 1974 - Mar. 1975
J. T. Neu and M. F. Dorian 10 Jan. 1977 140 p
(Contract F04701-74-C-0318)
(AD-A034864; SAMSO-TR-76-92-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 22/2

Contents: experimental directional-hemispherical reflectance from 0.28 to 2.5 micrometers and calculation of solar absorptance, experimental directional-hemispherical reflectance from 2.0 to 30 micrometers and calculation of thermal emittance, bidirectional reflectance, test plan second surface mirrors, hemispherical-directional reflectance 0.3 to 7.0 micrometers, directional-hemispherical reflectance ERAS format, directional-hemispherical reflectance, and directional emittance 2.5 to 30 micrometers and 200 to 700 K, directional-hemispherical reflectance (U.V., Vis, Near I.R.), bidirectional reflectance, theory and computer programs for substrate design. GRA

N77-23428# California Univ., Berkeley. Water Resources Center.
MIXING OF SUBMERGED TWO-DIMENSIONAL BUOYANT JETS IN UNIFORM BODIES OF WATER IN THE ABSENCE AND PRESENCE OF WIND ACTION Ph.D. Thesis
Shin-Lin Liu Jun. 1976 160 p refs
(PB-263094/5; UCAL-WRC-W-306) Avail: NTIS HC A08/MF A01 CSCL 20D

The mixing and flow behavior of submerged buoyant jets, discharged from sources with no initial net horizontal momentum flux into bodies of water of uniform density in the absence and presence of wind action, were studied. A mathematical model, based on the initial fluxes of buoyancy and momentum, was developed to help describe the buoyant jet behavior in stagnant water of infinite depth. This model was confined to a slot source discharging vertically. A numerical solution of the model in terms of the characteristic source parameters was provided. The results were applied to the finite depth base when the free surface has no effect. GRA

N77-23429# Cincinnati Univ., Ohio. Dept. of Chemical and Nuclear Engineering.
FLOW PATTERNS AND PRESSURE DROP IN HORIZONTAL TWO-PHASE PIPE FLOW
W. G. Choe and J. Weisman Mar. 1976 192 p refs
(Grant NSF GK-40490)
(PB-263080/4) Avail: NTIS HC A09/MF A01 CSCL 20D

Two phase flow patterns in pipes were classified as separated, intermittant, annular, and homogeneous. Improved correlations for the flow pattern transactions defined by classification were determined. A generalized flow pattern map is proposed. The generalized flow pattern map was used to segregate two phase pressure drop data according to flow pattern. It was found that the Lockhart-Martinelli correlation fit the data in the intermittant and annular regions while the Hoogendorm correlation fit the separated region. A modified, homogeneous approach provided best agreement in the homogeneous region. GRA

N77-23430# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
MULTISTAGE HYDRAULIC SUMMING AND SIGNAL PROCESSING AMPLIFIERS AND FLUIDIC INPUT SERVO-VALVE DEVELOPMENT Final Report
David Lee and David N. Wormley Oct. 1976 71 p refs
(Contract DAAG39-73-C-0223)
(AD-A034673; EPL-81202-1; HDL-CR-76-223-1) Avail: NTIS HC A04/MF A01 CSCL 09/5

The development of fluidic summing and dynamic signal compensation operational amplifiers for high performance hydraulic systems is described. The amplifiers are constructed from three stage fluid amplifiers using as input and feedback elements linear resistors constructed from small diameter to length ratio tubing and capacitors constructed from flexible metal diaphragms. The summing amplifier has a pressure gain of 50 and a frequency response which is flat to 100 Hz. Dynamic compensation elements were constructed with lead-lag action where the lead action dominates in the 20 to 40 Hz range. A four-way fluidic input servovalve has been developed. The valve consists of a fluid amplifier driving a pair of bellows that act directly on the flapper of the first stage flapper-nozzle valve, and a second stage spool valve whose position is controlled by the output of the first stage valve. The valve accepts pressure inputs in the 0 to 7 kPa range and has a frequency response which has decreased by 3 dB at 30 Hz. Author (GRA)

N77-23431# Wisconsin Univ., Madison. Mathematics Research Center.
A MODEL FOR VISCOELASTIC FLUID BEHAVIOR WHICH ALLOWS NON-AFFINE DEFORMATION
M. W. Johnson, Jr. and D. Segalman Sep. 1976 23 p refs
(Contract DAAG29-75-C-0024)
(AD-A034481; MRC-TSR-1685) Avail: NTIS HC A02/MF A01 CSCL 12/2

A continuum theory of viscoelasticity is developed which allows non-affine deformation, defined in an appropriate manner. The constitutive equation is a generalization of that obtained from molecular theory with the addition of one scalar parameter which becomes important for large deformations. The theory is applied to simple shear flows, the scalar parameter being determined to match certain experimental data. The theory shows good agreement with all data examined. The paper concludes with the development of a general non-affine thermodynamic theory. Author (GRA)

N77-23432# Auburn Univ., Ala. Dept. of Mechanical Engineering.
PERFORMANCE OF AIR-AUGMENTED WATERJET THRUSTERS Final Report, 1 Apr. 1975 - 30 Nov. 1976
D. F. Dyer, G. Maples, H. T. Cansler, and J. C. Maxwell, Jr. 30 Nov. 1976 59 p refs
(Contract N00014-75-C-0936)
(AD-A034164) Avail: NTIS HC A04/MF A01 CSCL 13/10

This report describes an investigation of the performance of air-augmented waterjet thrusters. The investigation is divided into two parts. Part one describes a study of the injection of large diameter air bubbles to reduce heat transfer between the air and water and, thus, increase the thrust. This study is done analytically by solving the appropriate, governing equations. The

results indicate that the approach is very worth-while since thrust can be increased ten percent as compared to air-augmentation with small bubbles. Several practical systems are discussed for injecting large air bubbles. Part two is an experimental investigation of the thrust produced under a wind range of conditions. The results show that a thrust increase of more than 20 percent can be achieved by air-augmentation. Further, the performance improves for larger thrust nozzles. Author (GRA)

N77-23433# Physical Sciences, Inc., Woburn, Mass.
AN ANALYSIS OF NOSETIP BOUNDARY LAYER TRANSITION DATA Interim Report, 1 Jul. 1975 - 30 Jun. 1976
Michael L. Finson Aug. 1976 47 p refs
(Contract F44620-74-C-0022; AF Proj. 6813)
(AD-A034917; PSI-TR-52; AFOSR-76-1106TR) Avail: NTIS HC A03/MF A01 CSCL 16/2

Available wind tunnel data simulating nosetip boundary layer transition on reentry vehicles is analyzed. It is agreed that transition should depend on surface roughness, surface temperature, and surface curvature. The Reynolds number based on momentum thickness at the transition location (Re sub theta) is used to measure transition, and the surface roughness effect is described by the Reynolds number - Re sub k,k based on roughness height and conditions at the tops of the roughness elements. The wall temperature dependence may be removed by use of the kinematic viscosity in the middle of the boundary layer to computer Re sub theta. The available data suggest a dependence on theta/R sub c (R sub c = surface radius of curvature), which could be due to centrifugal acceleration or pressure gradient. Accounting for this curvature effect appears to eliminate the need for a separate transition onset criterion. A tentative correlation is presented, and the limitations of the existing data are discussed. GRA

N77-23434# Mathematical Applications Group, Inc., Elmsford, N. Y.
SOLUTION OF TIME-DEPENDENT HEAT CONDUCTION EQUATION IN COMPLEX GEOMETRY BY THE MONTE CARLO METHOD Final Report
Eugene S. Troubetzkoy, Malvin H. Kalos, Herbert A. Steinberg, Norman E. Banks, and George J. Klem Aberdeen Proving Ground, Md. Ballistics Res. Lab. Dec. 1976 80 p refs
(Contract DAAD05-73-C-0501; DA Proj. 1W1-61102-AH-43)
(AD-A034513; BRL-CR-325) Avail: NTIS HC A05/MF A01 CSCL 12/1

A Monte Carlo method has been developed to solve the time-dependent heat conduction or diffusion equation. This method is a generalization of the floating sphere method to rectangular parallelepipeds. Green's functions are developed which satisfy the appropriate boundary conditions. Probability distributions based on these Green's functions are determined and random walk techniques are used to estimate a solution. The method is capable of handling various boundary conditions and complex three-dimensional configurations. Author (GRA)

N77-23435# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Aeroballistics Directorate.
AN EXPLORATORY INVESTIGATION ON REDUCING SUPERSONIC MISSILE DRAG BY FLUID INJECTION INTO A TURBULENT BOUNDARY LAYER
Donald Rubin 1 Nov. 1976 54 p
(DA Proj. 1W3-62303-A-214)
(AD-A034522; RD-77-7) Avail: NTIS HC A04/MF A01 CSCL 16/3

To determine general effects of fluid injection into a turbulent boundary layer on missile drag and stabilizing forces at angle of attack, an exploratory investigation was made at Mach 1.63 and 2.2. The test model was a body of revolution 10-cal long with a 3-cal tangent ogive nose and stabilizing fins. The mass injection was simulated by nitrogen and injected into the boundary layer from a porous section just aft of the nose body junction. The porous section was varied in length from 0.5 to 1.5 cal. Angle of attack range varied from -3.5 deg to -19 deg. Author (GRA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N77-23436 Connecticut Univ., Storrs.
HOLOGRAPHIC ANALYSIS OF BODY DEFORMATIONS Ph.D. Thesis
Ryszard Jan Pryputniewicz 1976 317 p
Avail: Univ. Microfilms Order No. 77-6165

A general theory of holographic strain analysis is developed along with methods of determination of the sensitivity vectors directly from holograms. Several of the existing techniques of holographic displacement measurement are discussed using unified notation and their experimental reliability compared in various test situations. To aid in the analysis and data reduction, computer programs were developed to solve the governing equations of the theory of homogenous body deformations as well as the governing equations of the various techniques of holographic displacement measurements. The theory was applied in clinical orthodontics where the ability to predict the movement of a tooth under the influence of external forces is the basic problem. The results presented show that the holographic technique of rigid body motions and strain analysis is very accurate and reliable. This technique can be applied to the analysis of any kind of an arbitrary three-dimensional object and the developed computer programs used to reduce experimental data. Dissert. Abstr.

N77-23437 Princeton Univ., N. J.
AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF A TIME-OF-FLIGHT AEROSOL SPECTROMETER Ph.D. Thesis
Michael Howard Schwartz 1976 381 p
Avail: Univ. Microfilms Order No. 77-6035

A technique which has promise as a flexible and sensitive particle size analysis system, Time Of Flight Aerosol Spectroscopy (TOFAS) was investigated. A theoretical basic for the technique is presented for the case of hard sphere type particles, and molecular species following an inverse-six potential suspended in a light carrier gas such as air or helium. The theoretical resolution limits of a Time-Of-Flight Aerosol Spectrometer are also identified. For each case experimental data is presented to test the validity of the appropriate theoretical predictions. Dissert. Abstr.

N77-23438*# Perkin-Elmer Corp., Pomona, Calif. Aerospace Div.
DEVELOPMENT OF A DRIVE SYSTEM FOR A SEQUENTIAL SPACE CAMERA CONTRACT MODIFICATION 4(S) Final Report
James T. Sharpsteen, Duard L. Lund, Curtis D. Solheim, and Louis J. Stoap Apr. 1977 26 p
(Contract NAS9-14573)
(NASA-CR-151342; SPO-30352) Avail: NTIS HC A03/MF A01 CSCL 14E

The brush type dc motor and clutch were eliminated from the design of the 16 mm space sequential camera design and replaced by an electronically commutated motor. The new drive system reduces the current consumption at 24 fps to 220 mA. The drive can be programmed and controlled externally from the multipurpose programmable timer/intervalometer, as well as being controlled locally from the camera. Author

N77-23439*# Energetics Science, Inc., Elmsford, N. Y.
A STUDY FOR HYPERGOLIC VAPOR SENSOR DEVELOPMENT Final Report, 8 Jun. 1976 - 8 Apr. 1977
Joseph R. Stetter 8 Apr. 1977 94 p refs
(Contract NAS10-8982)
(NASA-CR-153048) Avail: NTIS HC A05/MF A01 CSCL 14B

The use of an electrochemical technique for MMH and NO2

measurement was investigated. Specific MMH and NO2 electrochemical sensors were developed. Experimental techniques for preparation, handling, and analysis of hydrazine's vapor mixtures at ppb and ppm levels were developed. Two approaches to NO2 instrument design were evaluated including specific adsorption and specific electrochemical reduction. Two approaches to hydrazines monitoring were evaluated including catalytic conversion to NO with subsequent NO detection and direct specific electrochemical oxidation. Two engineering prototype MMH/NO2 monitors were designed and constructed. Author

N77-23440*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PERFORMANCE CHARACTERISTICS OF A THREE-AXIS SUPERCONDUCTING ROCK MAGNETOMETER
Barry R. Lienert Feb. 1977 25 p ref Submitted for publication
(NASA-TM-X-71304; X-691-77-37) Avail: NTIS HC A02/MF A01 CSCL 14B

A series of measurements are carried out with the purpose of quantitatively determining the characteristics of a commercial 6.8 cm access superconducting rock magnetometer located in the magnetic properties laboratory at the Goddard Space Flight Center. The measurements show that although a considerable improvement in measurement speed and signal to noise ratios can be obtained using such an instrument, a number of precautions are necessary to obtain accuracies comparable with more conventional magnetometers. These include careful calibration of the sensor outputs, optimum positioning of the sample within the detection region and quantitatively establishing the degree of cross-coupling between the detector coils. In order to examine the uniformity of response for each detector, the responses are mapped as a function of position, using a small dipole. Author

N77-23441*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DIFFERENTIAL SOUND LEVEL METER Patent Application
Allan J. Zuckerwar, inventor (to NASA) (Old Dominion Univ., Norfolk, Va.) Filed 8 Nov. 1976 24 p Sponsored by NASA
(NASA-Case-LAR-12106-1; US-Patent-Appl-SN-740156) Avail: NTIS HC A02/MF A01 CSCL 14B

A device for measuring small differences between relatively high sound pressure levels at two different microphone sites is described. Electrical insertion voltages, pilot voltages, are used as a means for continuously monitoring the gains of two acoustical channels. The difference between two pilot voltages is utilized to force the gain of one channel to track the other channel. NASA

N77-23442# Los Alamos Scientific Lab., N. Mex.
STRETCHED-WIRE, REMOTE, POSITION-SENSING DEVICE FOR EPICS
N. Ensslin, S. J. Greene (Colorado Univ., Boulder), and H. A. Thiessen May 1976 30 p ref
(Contract W-7405-eng-36)
(LA-6381) Avail: NTIS HC A03/MF A01

A description is given of design considerations, physical layout, electronics, and PDP-11 computer programming for the Energetic Pion Channel and Spectrometer (EPICS) taut-wire system. EPICS is a high-resolution pion channel and spectrometer facility at Los Alamos Meson Physics Facility (LAMPF). The taut-wires are remote, position-sensing devices attached to the relatively inaccessible channel magnets for monitoring their relative positions. ERA

N77-23443# Instituut TNO voor Werktuigkundige Constructies, Delft (Netherlands).
APPLICATIONS OF STRAIN GAGES IN A WATER-FILLED PRESSURE VESSEL [TOEPASSINGEN VAN REKSTROOKJES IN EEN MET WATER GEVULD DRUKVAT]
P. Tegelaar Oct. 1976 48 p refs Partly in DUTCH and ENGLISH; ENGLISH summary
(Contract A75/KM/122)
(IWECO-11939; TDCK-68599) Avail: NTIS HC A02/MF A01

Strain gages, protective coatings, cable feed-throughs, and cable joints were tested in a pressure vessel in water with a pressure up to 150 bar. The test consisted of a static part (for two months) and a dynamic part (2000 cycles) Topics dealt with include the choice of strain gages, the construction of the pressure vessels, and the strain gage seals and strain gage cable feed-through tests. Author (ESA)

N77-23444# Chemical Lab. RVO-TNO, Rijswikj (Netherlands).
EXPERIMENTS WITH THE STOEBER CENTRIFUGAL AEROSOL SPECTROMETER: CALIBRATION AND TEST EXPERIMENTS
F. Oeseburg Oct. 1975 43 p refs
(CL-1976-6; TDCK-67614) Avail: NTIS HC A03/MF A01

A centrifugal aerosol spectrometer was calibrated using quasi monodisperse polystyrene latex aerosols. The calibration was executed under experimental conditions used in sampling with flow rates of 0.1 standard liter per minute (sl/min), 0.43 sl/min, and 1.9 sl/min. The reproducibility of the deposition distance of the aerosol particles was determined. The standard deviation amounted to about 0.6 percent. The accuracy of the determination of the particle diameter is generally lower (standard deviation 0.6 to 1.5 percent) because it also depends on the slope of the curve representing the logarithmic relation between the deposition distance and the aerodynamic diameter. The reproducibility of the profiles of the deposits is moderate. Strong asymmetric profiles are sometimes observed. The relative resolving power of the spectrometer varies with the experimental conditions. Author (ESA)

N77-23445# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
MEDIUM ENERGY CHARGED PARTICLE SPECTROMETER. EXPERIMENT E8 HELIOS Final Report
Erhard Keppler, Berend Wilken, Klaus Richter, Gerhard Umlauft, Klaus Fischer, and Hans-Peter Winterhoff Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1976 205 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-390)
(Contracts BMFT-WRS-0107; GfW-01H3008)
(BMFT-FB-W-76-14) Avail: NTIS HC A10/MF A01; ZLDI, Munich DM 43.05

The charged particle spectrometer E8 onboard Helios A and B is described. The experiment covers proton energies from 80 keV to 6 MeV, electron energies from 20 keV to 2 MeV, and positron energies from 150 to 550 keV. Flight performance is discussed, and selected examples are used to demonstrate the instrument's properties. ESA

N77-23446# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
ULTRASONIC CALORIMETER FOR BEAM POWER MEASUREMENTS
Thomas L. Zapf, Morris E. Harvey, Neil T. Larsen, and Robert E. Stoltenberg Sep. 1976 39 p refs Sponsored in part by Bureau of Radiol. Health, Rockville, Md.
(PB-260666/3; NBS-TN-686) Avail: NTIS HC A03/MF A01 CSCL 14B

An ultrasonic calorimeter was designed and constructed for the measurement of beam power up to a few watts from ultrasonic transducers. The calorimeter, described as a twin, series flow, ultrasonic calorimetric comparator, operates in the frequency range from 1 to 15 MHz with uncertainties less than plus or minus (7% + 0.2 mW). Twin vessels are provided so that thermal effects of an ultrasonic sound beam absorbed in one vessel can be compared rapidly with accurately measured dc electrical power in the other vessel. GRA

N77-23447# National Bureau of Standards, Washington, D. C. Inst. for Basic Standards.
THE NATIONAL MEASUREMENT SYSTEM FOR PRESSURE
Peter L. M. Heydemann Sep. 1976 42 p refs
(PB-261030/1; NBSIR-75-931) Avail: NTIS HC A03/MF A01 CSCL 14B

The state of the national measurement system for pressure in the range where NBS presently provides calibrations and related services is summarized. Needs for expansion of the range were identified. Rapid changes in the needs of the system are generated by the increased use of transducers to transfer measurements and plans are being implemented at NBS to provide all necessary services. GRA

N77-23448# Epsilon Labs., Bedford, Mass.
IMPROVEMENTS AND MODIFICATIONS TO THE EPSILON/AFGL BALLOON-BORNE SUB-MICRON PARTICLE COUNTER Final Report, Nov. 1975 - Aug. 1976
Henry A. Miranda, Jr. and John Dulchinos Hanscom AFB, Mass. AFGL Sep. 1976 16 p
(Contract F19628-76-C-0104; AF Proj. 7621)
(AD-A031312; AFGL-TR-76-0211) Avail: NTIS HC A02/MF A01 CSCL 04/1

Several improvements and modifications have been incorporated in the device which greatly facilitate preparation of the equipment for flight and pre-flight calibration. Notable among these is a means which has been developed for relieving microstresses in the magnetic recording tape which had been troublesome in the past. Also corrected was a slight discontinuity in the pulse height binning process which had proven to be elusive in the past due to its intermittency. An investigation was conducted which established the feasibility of working with reduced forward scattering angles. This in turn permits a much more compact optical system to be designed. Author (GRA)

N77-23449# Defense Mapping Agency Topographic Center, Washington, D.C.
CONVERSION OF BLACK-AND-WHITE PHOTOGRAPHY TO FOUR-COLOR LITHOGRAPHY Preliminary Report, Aug. 1970 - May 1971
Hale M. Luig May 1976 16 p refs
(AD-A033610; DMATC-TR-76-2) Avail: NTIS HC A02/MF A01 CSCL 14/5

The purpose of this study was to determine the feasibility of a new technique, colorization, for converting black-and-white photography to naturalistic color for orthophotographics. The cartographic reproduction process is based on a simulated color separation of the black-and-white imagery into the four components required for process printing, i.e., yellow, magenta, cyan, and black. This initial test was confined to a 7 1/2- by 11-inch black-and-white aerial photo from which four positive separations were colorized. Minimal indicia were added by hand. Thus, in combination, a pictorially naturalistic graphic, with minimal cartographic treatment, was rendered in full color for visual inspection. An equivalent full color proof on an opaque white substrate was produced from subsequent negatives in conjunction with a dropout roads mask. The technique appears to offer the combined advantages of black-and-white photography for contrast and color imagery for interpretation, while surpassing both additive color systems and complex subtractive methods in economic prudence. Author (GRA)

N77-23450# Comstock and Wescott, Inc., Cambridge, Mass.
DOUBLE-DECK SOLAR EXTREME ULTRAVIOLET SPECTROMETERS Final Report, 1 May 1973 - 30 Jun. 1976
John F. McGrath and Joseph P. Padur 31 Jul. 1976 116 p
(Contract F19628-73-C-0253; AF Proj. 6688)
(AD-A032810; AFGL-TR-76-0160) Avail: NTIS HC A06/MF A01 CSCL 14/2

This report describes the design, development, and fabrication of two solar extreme ultraviolet double spectrometers for sounding rockets. Both instruments are of the grazing-incidence grating spectrometer design. The report also describes the design and fabrication of ground support equipment (GSE) for the two instruments and field services supporting the launch of two instruments. Author (GRA)

N77-23451# ARO, Inc., Arnold Air Force Station, Tenn.
CORRECTIONS TO SINGLE-SHIELDED TOTAL TEMPERATURE PROBES IN SUBSONIC, SUPERSONIC, AND HYPERSONIC FLOW Final Report, Oct. 1975 - Aug. 1976
M. O. Varner AEDC Nov. 1976 37 p refs
(AD-A032725; ARO-VKF-TR-76-95; AEDC-TR-76-140) Avail: NTIS HC A03/MF A01 CSCL 14/2

A new total temperature measurement correction is developed for the single-shielded type of probe. This method is based on a detailed analysis of the coupled heat transfer-viscous flow region existing within the probe. The correction is valid for all flow-field conditions and requires probe calibration data only in the free stream where flow properties are known. Total temperature measurements on the windward ray of a 4-deg sharp cone at Mach 10 in AEDC Hypersonic Tunnel (C) are used in conjunction with corresponding theoretical predictions to substantiate the present analysis. The new approach appears to be a significant improvement over present methods. Author (GRA)

N77-23452# University Coll., London (England). Dept. of Electronic and Electrical Engineering.
MICROWAVE SCANNING AND ASW HOLOGRAPHIC TECHNIQUES FOR NDT Final Technical Report, Sep. 1975 - Feb. 1976
Eric A. Ash and Anis Husain Jun. 1976 118 p refs
(Grant DA-ERO-591-74-G0019; DA Proj. DO1-61102-B-33F)
(AD-A033879) Avail: NTIS HC A06/MF A01 CSCL 13/8

The feasibility of using two new techniques for non-destructive testing applications, one based on the use of microwaves, the other on acoustic surface waves was explored. The microwaves scanning microscope technique differs from other microwave n.d.t. systems in that it aims not only to determine the existence of a defect, but also to locate it. The location is effected with an accuracy which is more than two orders of magnitude better that the wavelength of the microwaves used. The acoustic surface wave technique differs from those previously employed in that the authors have adopted a holographic technique, whereby it is possible to record the acoustic field along a single line, and from this recover the complete field. It is therefore able to detect defects in the surface of a sample by reconstruction based on a single record. The method is based on the use of a phase sensitive laser probe, followed by subsequent computer reconstruction. Using this technique, the authors have been able to detect very small defects on a quartz surface. It is possible that the technique can be used effectively for determining surface flaws in highly polished surfaces. GRA

N77-23453# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE THEORY OF DIFFRACTION FROM A HOLOGRAPHIC LENS Ph.D. Thesis
Daniel D. Young Dec. 1976 212 p refs
(AD-A034882; DS/PH/76-4) Avail: NTIS HC A10/MF A01 CSCL 20/6

The objective of this effort was to apply diffraction theory to calculate the diffraction efficiency of a holographic lens in terms of the original geometry, exposure conditions, material parameter, processing effects, and reconstruction geometry. The analysis was based upon a pair of coupled wave equations with variable coefficients of sufficient generality to permit the determination of the diffraction efficiency in cases where previous theories have been limited. GRA

N77-23454# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
AN EXAMPLE OF AN INFINITE DIMENSIONAL FILTERING PROBLEM: FILTERING FOR GYROSCOPIC NOISE Interim Report
L. Horowitz and S. K. Mitter 29 Oct. 1976 11 p refs Presented at Decision and Control Conf., Clearwater Beach, Fla., Dec. 1976
(Grant AF-AFOSR-2273-72)
(AD-A034016; ESL-P-691; AFOSR-76-1315TR) Avail: NTIS HC A02/MF A01 CSCL 09/4

An infinite-dimensional model is given for the generation of gryroscopic noise, which exhibits power spectral density proportional to (1/f) over a wide frequency range. The optimal filter is given for separating a statistically described signal from additive gyroscopic noise, using discrete-time observations. This filter is expressed as a discrete-time infinite-dimensional Kalman-Bucy filter, with an associated Riccati covariance operator equation. Sufficient conditions are specified such that this Kalman-Bucy filter will possess various desired properties. Author (GRA)

N77-23455# Air Force Flight Test Center, Edwards AFB, Calif.
PHOTOGRAPHY IN SCIENTIFIC RESEARCH: SELECTED BIBLIOGRAPHY AND REFERENCE MATERIALS Final Report
Louis Harris Cohen Jul. 1976 356 p
(AD-A034497; AFFTC-TIH-76-4) Avail: NTIS HC A16/MF A01 CSCL 14/5

Contents: aerial and underwater photography; high-speed photography--applications, equipment, principles and processes; holography and lasers--principles and applications; optics--basic principles, design, instrumentation problems, plastic optics and fiber optics; reference materials--dictionaries, handbooks, guidebooks, encyclopedias, glossaries and selected collections; science and technology--astronomy, close-up photography, infrared photography, photomicrography, photomacrography, scientific research, symposiums, techniques in biology and medicine, and television; high-voltage photography (Kirlian photography); abstracts, indexes, bibliographical sources; brochures, dissertations, speeches, masters' theses, reports, translations and technical notes; kinesiology--selected materials; journals and periodicals--selected articles; selected list of journals and periodicals for use as reference materials; photographic reference materials; index. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N77-23456 New York Univ., N. Y.
A DYNAMICAL THEORY OF STATIONARY SELF-FOCUSING OF LASER BEAMS Ph.D. Thesis
Juan Francisco Lam 1976 91 p
Avail: Univ. Microfilms Order No. 77-5424

This work has provided the following contributions to the field of self-action of powerful laser beams: (1) a treatment of the effect of saturation of the nonlinear response of matter on the spatial behavior of the laser radiation; (2) an account of the equilibrium criteria for a stable self trapped laser mode and the frequency of stable oscillations about equilibrium; (3) a discussion of the state plane representation of self-focusing which leads to a clear cut picture of the phenomenon without having to solve the equation of motion; and (4) a generalization to the case of a laser beam propagating in an active medium, including the effect of a constant gain or loss on a self-trapped mode in the adiabatic limit. Dissert. Abstr.

N77-23457 Yeshiva Univ., New York.
THE EFFECTS OF HYDROSTATIC PRESSURE ON THE EMISSION OF A(X)Ga(1-X)As LASER DIODES Ph.D. Thesis
Leon Yehuda Juravel 1976 165 p
Avail: Univ. Microfilms Order No. 77-4996

The threshold current dependence on pressure was analyzed in terms of a simple model of carrier loss from the direct conduction band minimum accounting for the steep rise is threshold current pressure dependence above 15% Al concentration. The difference between the experimental results and the model follows very well the negative of the spontaneous emission pressure dependence indicating that a decrease in non-radiative lifetime under pressure, a quantity which is otherwise difficult to measure, is responsible for both effects. Dissert. Abstr.

N77-23458 California Univ., Berkeley.
OPTICAL GAIN IN GaAs Ph.D. Thesis
Jiunn-Yau Liou 1976 77 p
Avail: Univ. Microfilms Order No. 77-4514

Utilizing optical pumping techniques with the active medium excited in a stripe geometry, the amplified spontaneous emission and absorption spectra are measured monolithically at 77 K. Gain and absorption spectra are deduced from these results. It has been found that the band to band transitions (intrinsic band plus impurity band) dominate the emission and absorption spectra in heavily doped GaAs. The electronic band model described by Halperin-Lax-Hwang provides an appropriate picture for heavily doped GaAs. Also, the energy gap is shrunk by both the impurity ion cores and exchange interaction among the populated carriers. Dissert. Abstr.

N77-23459*# Aerospace Corp., Los Angeles, Calif. Electronics Research Lab.
LOW THRESHOLD CW Nc LASER OSCILLATOR AT 1060 nm STUDY Final Report, 10 Jun. 1975 - 14 Jun. 1976
M. Birnbaum and L. G. DeShazer (Southern Calif. Univ., Los Angeles) 7 Jul. 1976 127 p refs
(Contract NAS5-22387)
(NASA-CR-152490) Avail: NTIS HC A07/MF A01 CSCL 20E

A broad range of characteristics of neodymium/yag lasers were investigated. With Nd:YVO4 crystals, CW 1.06 mu lasers were operated with thresholds a factor of 2 lower than Nd:YAG and with greater slope efficiencies. Thus, the first step in the development of new oscillators suitable for application in high data rate laser communication systems which surpass the present performance of the Nd:YAG laser has been successfully demonstrated. Author

N77-23460# Cornell Univ., Ithaca, N.Y.
SPIN FLIP RAMAN LASER STUDIES Technical Progress Report, 1 Jan. - 31 Dec. 1976
G. J. Wolga 30 Sep. 1976 12 p
(Contracts EY-76-S-02-2848; E(11-1)-2848)
(COO-2848-1) Avail: NTIS HC A02/MF A01

Spin flip Raman laser operation in InSb was studied using different cavity configurations in which the laser crystal was placed simultaneously in the pump and Raman laser resonators. The two configurations studied were: an anti-resonant ring end mirror for the pump cavity with the crystal inside the ring; the pump and Raman cavities coupled through a Brewster flat beam splitter with low loss orientation for the pump cavity. The properties of the ring configuration were studied with emphasis placed upon pump resonator losses. This configuration has not yet lased. The absorption by InSb of pump power was measured as a function of wavelength between 5.2 to 5.5 microns. Optimized InSb crystal lengths were determined from the measured pump power absorption coefficient, and new crystals were procured for the Brewster flat configuration. This configuration was successfully lased and tuned using the short crystals. Stimulated Raman scattering from Landau levels in InSb was observed. The final quarterly period of the Contract will be devoted to optimization studies of the two resonator configurations. ERA

N77-23461# Los Alamos Scientific Lab., N. Mex.
USE OF PICOSECOND LASERS FOR STUDYING PHOTOSYNTHESIS
A. J. Campillo and S. L. Shapiro 1976 21 p refs Presented at 20th Ann. SPIE Tech. Symp., San Diego, Calif., 23 Aug. 1976
(Contract W-7405-eng-36)
(LA-UR-76-1868; Conf-760832-9) Avail: NTIS HC A02/MF A01

The recent application of picosecond laser techniques to the study of photosynthesis is reviewed. Two techniques are emphasized. In the first, a streak camera is used in conjunction with a mode locked laser to determine the exciton migration time to the photosynthetic reaction center. In the second, a novel nonlinear optical technique is described which enables certain deductions to be made about the topology of the photosynthetic unit. Bacteria and higher plant data are presented. ERA

N77-23462# Institut Franco-Allemand de Recherches, St. Louis (France).
APPLICATIONS OF LASER VELOCIMETERS TO AERODYNAMICS [APPLICATIONS DU VELOCIMETRE LASER EN AERODYNAMIQUE]
J. P. Hancy 3 Jun. 1976 38 p refs In FRENCH Presented at the Conf. Appl. du Laser aux Mesures des caracteristiques des Ecoulements Fluides. Interferometrie Holographique et Anemometrie Doppler, Bordeaux, 17-20 May 1976
(ISL-CO-203/76) Avail: NTIS HC A03/MF A01

Some applications of laser Doppler velocimeters are discussed. They include low velocity applications such as flow around a wing profile, free jet probing and comparison with hot-wire anemometry performance, combination of laser Doppler velocimeters to a Bragg cell for very low speed flow measurements, retrodiffusion measurements, etc., as well as high speed flow applications such as flow measurements in the ISL supersonic wind tunnel and in industrial wind tunnels and boundary layer measurement in a supersonic wind tunnel. Another application of the laser velocimeter is high temperature flow research such as flame measurement in a nozzleless combustion chamber. ESA

N77-23463# Physics Lab. RVO-TNO, The Hague (Netherlands).
MODE-LOCKING OF A Nd-YAG LASER
F. G. Kuiper Jul. 1976 29 p refs In DUTCH; ENGLISH summary
(PhL-1976-31; TDCK-67956) Avail: NTIS HC A03/MF A01

Theoretical considerations concerning mode-locking (a means for generating very short laser pulses) are given and two ways in which a Nd-YAG laser can be mode-locked are described. The first method gives pulses with a small amount of energy and has the additional disadvantage of being irreproducible. Mode-locking by means of the saturable dye bis(4-dimethylaminodithiobenzil)nickel proved very successful. In this case pulses with a peak power of about 75 MW and a pulse width of about 60 ps were generated. The design of a mode-locked laser that can be used as a light source for creating stimulated Raman scattering is presented. Author (ESA)

N77-23464# Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md.
EVALUATION OF THE LASER INSTRUMENTATION BEACON DEVELOPED FOR OPERATIONAL TEST AND EVALUATION AGENCY, SEPTEMBER - OCTOBER 1976 Nonionizing Radiation Protection Special Study Report
Terry L. Lyon 3 Dec. 1976 8 p
(AD-A033379; USAEHA-42-0306-77) Avail: NTIS HC A02/MF A01 CSCL 06/18

A laser radiation protection special study of the laser instrumentation beacons constructed for the Operational test and Evaluation Agency by Harry Diamond Laboratories was conducted by this Agency on 16 September 1976. Radiometric measurements indicated that these systems are Class II He-Ne laser products and, therefore, do not pose a momentary viewing hazard. It is recommended that unprotected personnel not be permitted to stare into the beam within 81 m of the laser or 1 km when viewing thru optical instruments, that the attenuating filters be used whenever possible to reduce the laser output, and that the appropriate warning label be conspicuously attached to the device housing. Author (GRA)

N77-23465# Air Force Weapons Lab., Kirtland AFB, N.Mex.
CURRENT STATUS OF HF/DF CHAIN CHEMICAL LASER Final Report
Charles W. Clendening, Jr. Nov. 1976 61 p refs
(AD-A033029; AFWL-TR-76-194) Avail: NTIS HC A04/MF A01 CSCL 20/5

Experimental performance of the H2 - F2 chain reaction chemical lasers has consistently fallen below the theoretically less advantageous F - H2 cold reaction. This report discusses the current status of chain laser modeling and considers the implications of the computer results. Experimental data have drastically changed the HF(V) V to T,R deactivation rate scale from V to V sup 2.3 independent of the deactivating species. A new H - HF(V) deactivation rate for V greater than or equal to 3 has been measured and determined to be approximately 10 to the 14th power/cc/mole sec. LAMP computer code results with the new kinetic rates have greatly improved the agreement between theory and experiment. The chain reaction for a chemical laser has been determined to be more efficient in the DF-CO2 transfer laser and the HF pulsed laser. GRA

N77-23466# Cornell Univ., Ithaca, N.Y. Dept. of Chemistry.
STUDIES OF THE AUGMENTATION OF REACTION RATES VIA LASER IRRADIATION IN THE INFRARED Final Report, 1 Sep. 1973 - 31 Aug. 1976
S. H. Bauer, Earl R. Lory, and Kuei-Ru Chien 15 Oct. 1976 5 p
(Grant DA-ARO(D)-31-124-73-G195)
(AD-A033503; ARO-11848.4-C) Avail: NTIS HC A02/MF A01 CSCL 20/5

The objective of this research project, to discover a reaction involving a sizable substrate (more than three atoms) the rate of which is selectively augmented by infrared laser radiation, has been achieved. A preliminary analysis led to criteria for the selection of an optimum reaction type, and for setting the most suitable experimental parameters. The self-scavenging decomposition of a borane adduct: 2 H3BPF3 yields B2H6 - 2PF3, was studied. The relative photolytic efficiencies of the various lines emitted by a CO2 laser were measured as was also the dependence of the rate on laser power, gas pressure, and reaction cell temperature. Specificity of vibrational excitation was demonstrated in several ways, most directly by the observed isotope fractionation of H/D and 10 sub B/11 sub B ratios. The mechanism of the photoactivation process which as developed is in quantitative agreement with the observed conversion. A dynamic model (based on a normal mode analysis) was proposed for the selective activation. In a parallel study of borane adducts, the thermodynamic and kinetic rate parameters for six exchange and abstraction reactions was studied. Rational structures were proposed for the corresponding transition states. Author (GRA)

N77-23467# Hughes Research Labs., Malibu, Calif.
INVESTIGATION OF ULTRAVIOLET PHOTOIONIZATION SUSTAINED DISCHARGE FOR GAS LASERS Final Technical Report, 2 Jan. 1973 - 30 Jun. 1976
R. C. Lind Sep. 1976 142 p refs
(Contract N00014-73-C-0287; DARPA Order 1807)
(AD-A032731; FTR-2) Avail: NTIS HC A07/MF A01 CSCL 20/5

The primary objectives of this program were to establish whether a CO2 laser plasma, suitable for high power energy extraction, could be generated by the UV sustained technique, and to determine the scalability limits of the technique. These objectives were met and laser pulses with energies greater than 400J were extracted from a UV-sustained CO2 laser. A scaling model was developed which established that multikioljoule outputs at efficiencies of approximately 20 percent are possible if improvements in UV source brightness can be achieved. GRA

N77-23468# Illinois Univ., Urbana-Champaign. Dept. of Mechanical and Industrial Engineering.
THEORETICAL AND EXPERIMENTAL ANALYSIS OF THE CONSTANT-AREA, SUPERSONIC-SUPERSONIC EJECTOR Final Technical Report, 1 Oct. 1974 - 15 Jan. 1976
C. D. Mikkelsen, M. R. Sandberg, and A. L. Addy Oct. 1976 296 p refs
(Grant DAHC04-75-G-0046)
(AD-A033615; UILU-ENG-76-4003; ARO-12882.1-R-E) Avail: NTIS HC A13/MF A01 CSCL 20/5

A preliminary theoretical and experimental analysis was conducted of the constant-area, supersonic-supersonic ejector wherein one supersonic stream is pumped directly by another inside a confining duct. The theoretical analysis, based on a one-dimensional treatment of the constant-area mixing section and inviscid interaction region, is well suited to parametric evaluations and ejector optimization procedures. The experimental investigation of four, small-scale axisymmetric ejector configurations shows: (I) that the one-dimensional theory predicts maximum ejector compression ratios which are approximately 15 to 20 percent higher than the corresponding experimental values, and (II) that this ejector appears to be particularly susceptible to secondary flow separation. The one-dimensional analysis of the constant-area, supersonic-supersonic ejector was incorporated with a one-dimensional analysis of the conventional constant area, subsonic-supersonic ejector into a pumping system optimization procedure applicable to high-energy, chemical laser systems and supersonic wind tunnel systems. A comparison of optimum pumping system data shows that under certain conditions, a supersonic-supersonic pumping system has the potential for improved performance over that of a subsonic-supersonic pumping system. Author (GRA)

N77-23469# RCA Labs., Princeton, N. J.
INJECTION LASER FOR HIGH-DATA-RATE COMMUNICATION Progress Report
J. P. Wittke, I. Ladany, and H. Kressel Nov. 1976 10 p
(Contract N00014-76-C-0709)
(AD-A033415; PR-2) Avail: NTIS HC A02/MF A01 CSCL 20/5

The goal is the development of methods of coupling as much power from an injection laser as possible into a single-mode fiber, with the fiber permanently bonded to the laser in a protective package. Study of the factors controlling laser beam patterns continues. Some evidence of dimensional changes in the epoxy fiber-laser bonding has been seen; new epoxy is being tried. Several laser-fiber sealed packages have been assembled for evaluation. Power levels of about 1 mW have been coupled

into the fiber, and long-term stability is being studied.
Author (GRA)

N77-23470# Exxon Research and Engineering Co., Linden, N.J. Government Research Lab.
PHOTODISSOCIATION DYE LASER STUDIES AND HIGH PRESSURE DISCHARGE CONDITIONING STUDIES Final Report, 1 Oct. 1975 - 30 Sep. 1976
Abraham Kasdan and Robert J. L. Chimenti Nov. 1976 91 p refs
(Contract N00014-73-C-0048; ARPA Order 1806)
(AD-A033025; EXXON/GRU.4BEOR.76) Avail: NTIS HC A05/MF A01 CSCL 20/5

The results are presented of two distinct experimental efforts. The photodissociation dye laser (PDL) studies represent an effort to develop a new class of tunable liquid lasers, in which laser action occurs between the electronic states of radical produced via photodissociation of specific classes of organic molecules in solution. Specifically, five molecules from a group known as the hexaarylethanes were studied as potential laser media for the PDL scheme. Of these five molecules, only one - hexaphenylethane, exhibited radical fluorescence upon photodissociation. Measurements of the maximum gain and fluorescence yield indicate that attainment of laser action in this system was not of practical interest. The high pressure discharge conditioning studies involve an effort to generate and sustain spatially uniform discharges at pd values equal to or less than 1000 torr-cm by utilizing thermionic emission as the electron source. Using a heated cathode in a transverse discharge geometry, we have successfully demonstrated the attainment of long pulse, spatially uniform TEA discharges in several gases and gas mixtures with discharge currents lasting for 5 microsec. Author (GRA)

N77-23471# Naval Postgraduate School, Monterey, Calif.
SUB-AMBIENT CONTROLLED TURBULENCE EFFECTS ON DISCHARGE STABILIZATION FOR LASER APPLICATIONS M.S. Thesis
Howard Allen Post Sep. 1976 64 p refs
(AD-A032477) Avail: NTIS HC A04/MF A01 CSCL 20/5

This work deals with the effect of reduced pressure in a controlled turbulent flow on electric discharge stabilization. A converging-diverging nozzle was designed and fabricated to provide a device for investigating this phenomenon. Turbulence was generated by perforated plates designed with a geometry that had proven to be successful in previous controlled turbulent work. Turbulence and discharge data are presented along with photographs of the discharge for no flow, laminar flow, and turbulent flow. GRA

N77-23472# United Technologies Research Center, East Hartford, Conn.
OPTICALLY PUMPED LASER Final Technical Report, 15 Aug. 1975 - 15 Aug. 1976
Robert T. Brown 15 Oct. 1976 73 p refs
(Contract N00014-74-C-0376; ARPA Order 1807)
(AD-A033005; UTRC/R76-921853-12) Avail: NTIS HC A04/MF A01 CSCL 20/5

This report describes experimental and theoretical studies of a new technique for pumping high-pressure electric-discharge lasers. Various coupling geometries were examined and studies were made of the discharge temporal evolution and coupling efficiency. Diffuse discharges were obtained at pressures up to 20 atm in an optical configuration which allowed the incorporation of a UV optical cavity and which coupled over 95 percent of the 10.6 micrometers radiation into the discharge. Studies of various kinetic systems were carried out including He/N2 at 337.1 nm, He/N2 at 427.8 nm, Xe/F2/He at 354 nm, and Kr/F2/He at 249 nm. Author (GRA)

N77-23473# Systems Science and Software, La Jolla, Calif.
A STUDY OF COMPOSITE MATERIAL DAMAGE INDUCED BY LASER-SUPPORTED DETONATION WAVES Final Report, 1 Apr. 1975 - 30 Sep. 1976
J. R. Triplett and G. A. Gurtman Sep. 1976 34 p refs
(Contract N00014-75-C-0993; NR Proj. 064-569)
(AD-A033629; SSR-R-77-3019) Avail: NTIS HC A03/MF A01 CSCL 11/4

A model for ductile fracture is applied to the analysis of failure modes on a carbon-phenolic composite, loaded at the surface by a laser-supported detonation wave. It is demonstrated that for a 100 joule/cm square, 10 ns pulse, the model predicts failure of the sample as the third reflected tensile stress wave propagates through it. It is argued that high-intensity, short pulses are capable of producing damage efficiently in composites, but that with LSD surface loading rather than direct laser-target interaction the rapid stress relief required for front-surface spall failure is difficult to achieve. The attenuation of stress waves in the composite due to dispersion and viscous dissipation, the effects of defects in the virgin material, and the nucleation and growth parameters for cracks in different composite materials are critical factors in the analysis. Author (GRA)

N77-23474# Naval Postgraduate School, Monterey, Calif.
PHASE DISTORTION DUE TO AIRFLOW OVER A HEMISPHERICAL LASER TURRET
Allen E. Fuhs and Susan E. Fuhs Sep. 1976 38 p refs
(AD-A034204; NPS-69FU76101) Avail: NTIS HC A03/MF A01 CSCL 20/6

Compressible flow over a laser turret creates a phase distortion. To gain insight into this problem, a model of a hemispherical turret is developed. The flow field is obtained using a second order solution based on Janzen-Rayleigh expansion for the compressible potential flow equation. Contours of constant phase distortion were calculated; results at the critical Mach number are presented and discussed. It was found that the distortion at 0 degree elevation angle was equivalent to a positive lens, whereas at 90 degrees the distortion is similar to a negative lens. At 45 degrees the main effect is beam tilting into the wind. For a ratio of beam radius to turret radius equal to 0.5, the focal length at beam elevation angle of 0 degrees is 16.5km. At beam elevation of 54 degrees the beam tilt was found to be 26.5 microradians. Cruise missiles with intercontinental ranges may use celestial navigation which requires precise measurement of angular location of stars. A distorted lens created by the ambient flow field causes an error in measurement. Knowledge of the external aerodynamics is important. GRA

N77-23475# Hughes Research Labs., Malibu, Calif.
ELECTRON GUN TECHNOLOGY Final Report, 1 May 1972 - 30 Sep. 1976
William M. Clark, Jr. and Gilmore S. Dunning 2 Dec. 1976 91 p refs
(Contract N00014-72-C-0496; ARPA Order 1807)
(AD-A034170) Avail: NTIS HC A05/MF A01 CSCL 20/5

The first gun developed was the plasma cathode electron gun. The electron source in this device is a plasma generated within a low-voltage, hollow-cathode discharge; a thermionic emitter is not required. Electrons extracted from the plasma pass through a triode-type control grid structure and are accelerated to high energies in a plasma-free region prior to emerging from the gun through a thin foil window. The device, which is capable of both pulsed and CW operation, is characterized by durability, low cost, low power consumption, small size, and fast turn-on in comparison to thermionic e-guns. Most recent efforts on the program have been directed to developing the ion plasma electron gun. Potential advantages for this gun include high-voltage operation (=400 kV), high output current density (5 to 10 A/sq. cm. pulsed), pulsed and CW operation, monoenergetic e-beam, dc high voltage power supply for repetitively pulsed operation, and no control electronics floating at high voltage. In this gun, a low-pressure, thin-wire discharge produces ions which are accelerated to collide with the cathode. Secondary electrons are emitted at the cathode and are accelerated by the same high voltage and extracted through a foil window. Experimental results with a 4 cm x 40 cm aperture test device have demonstrated the concept of the ion plasma e-gun. GRA

N77-23476# Princeton Univ., N. J. Dept. of Chemistry.
COLLISIONAL STUDIES OF GASEOUS MOLECULAR LASERS
Herschel Rabitz May 1976 51 p refs
(Contract N00014-75-C-0478)
(AD-A025008; PR-3) Avail: NTIS HC A04/MF A01 CSCL 20/5

A variety of collisional and kinetic studies is under way to calculate the effects of molecular collisions in laser environments.

The research is proceeding on two main levels. First, a broad overview is being sought to discern the key physical parameters controlling collision behavior. Second, specific chemical systems are being studied as detailed applications of the theoretical methods developed. Within these categories research is being pursued in the following areas: (1) CO laser kinetics employing our newly calculated rate information, (2) model calculations for evaluation of quantum number and translational temperature scaling effects in collisional rates, (3) the development of a new stochastic theory for calculating collisional information in systems with many strongly coupled levels, and (4) detailed three-dimensional vibration-rotation calculations being performed on the H2- H2 system as a prototype for the behavior in complex laser situations. As a result of these calculations it has become evident that studies of this type can provide valuable help in the evaluation of laser performance. With is planned to vigorously pursue continuing work in these areas. Author (GRA)

N77-23477# Bureau of Radiological Health, Rockville, Md.
NATIONAL CONFERENCE ON MEASUREMENTS OF LASER EMISSIONS FOR REGULATORY PURPOSES Final Report
Robert H. James, ed. Oct. 1976 264 p refs Conf. proc. held at Rockville, Md., 4-7 Jun. 1974 Revised Sponsored in part by NBS
(PB-263419/4; DHEW/PUBL/FDA-76/8037; FDA/BRH-77/39) Avail: NTIS HC A12/MF A01 CSCL 20E

A conference was held to aid laser manufacturers and other interested parties in making measurements for a laser regulatory standard. Subjects covered include types of detectors, calibrations, control charts, quality control procedures, and measurement of lasers. NBS measurement services are discussed as well as measurement requirements of a regulatory performance standard for laser products. GRA

N77-23478# Pratt and Whitney Aircraft, West Palm Beach, Fla. Florida Research and Development Center.
CYLINDRICAL POLISHING TECHNOLOGY DEVELOPMENT PROGRAM Final Report, 3 Jun. 1974 - 31 Jul. 1975
Thomas B. Milan 31 Jul. 1975 27 p
(Contract N00014-74-C-0338)
(AD-A034680; PWA-FR-7108) Avail: NTIS HC A03/MF A01 CSCL 20/5

Cylindrical optical figures are needed for high energy laser (HEL) mirrors constructed of molybdenum material. The subject program determined the state-of-the-art for polishing molybdenum to cylindrical optical figures and advanced the technology within funding limits. Cylindrical optical figures of lambda/2 (lambda approx 0.5 micrometer) quality were determined to be state-of-the-art at PWA-FRDC during the early stages of the program, but this quality was subsequently improved to lambda/4. It proved to be impractical, if not impossible, to establish quantitative effects of the process variables, or to relate the process to spherical polishing technology. Of the several inspection techniques investigated, the glass test plate/monochromatic light interferometer and the noncontact slit interferometer (described in the text) appeared to be the best available techniques to ensure figure quality specifications are met. Author (GRA)

N77-23479# Physical Sciences, Inc., Woburn, Mass.
ANALYTIC MODELING OF ELECTRICALLY EXCITED D2/HCl AND HCl LASER EXPERIMENTS Final Report, 1 Aug. 1974 - 31 May 1976
R. Taylor, G. Caledonia, P. Lewis, P. Wu, J. D. Teare (W.J. Schafer Assoc., Inc., Wakefield, Mass.), and J. Cronin Jul. 1976 146 p refs
(Contract N00014-75-C-0035)
(AD-A034674; PSI-TR-58) Avail: NTIS HC A07/MF A01 CSCL 20/5

An analytic capability has been developed to model two types of laser experiments: (1) a D2/HCl EDL and (2) an e-beam sustainer discharge HCl laser. For the former device, a discharge in D2/inert gas mixtures provides excitation of the vibrational mode of D2. This gas is then supersonically expanded and HCl injected. The gases mix and flow into a cavity where vibrational energy transfer pumps the HCl. Complete modeling of this sequence of steps has been achieved. The relevant electron impact rate constants for D2 (and H2) as well as the vibrational energy transfer rate constants for the D2/HCl molecular system were selected from available data and theory. Comparison of the results of this model with data from the NRL EDL experiment were in qualitative agreement. A conceptual design of a next generation experiment was performed and indicates the requirement for an e-beam sustainer discharge operating at about one atmosphere plenum pressure. A D2/HCl EDL is predicted to be feasible. In the second experiment, HCl/inert gas mixtures are directly excited by a pulsed, high current e-beam sustainer discharge. The discharge conditions were modeled by developing a set of electron impact cross sections for HCl. The results of model calculations indicate that for the conditions of the NRL experiment, sufficient atoms may be generated in the discharge to prevent attainment of high gain. Definitive modeling of the atom generation is not possible at present. GRA

N77-23480# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE PLASMA LASER: POPULATION INVERSION IN HYDROGEN PLASMAS M.S. Thesis
John J. Campbell Dec. 1976 65 p refs
(AD-A034003; GEP/PH/76-1) Avail: NTIS HC A04/MF A01 CSCL 20/9

A rapidly recombining plasma preferentially populates the upper energy levels, thus producing population inversions. Laser devices in which the active medium is a recombining plasma are termed 'plasma' or 'recombination' lasers. A computer code was developed to determine the level populations of hydrogen as a function of time. The instantaneous cooling of the free electrons in a completely ionized hydrogen plasma was assumed. The resulting population inversion produced estimates of gain which were sufficient for laser action. The absorption of Lyman radiation in the plasma was also assumed. Generally, the effect of this absorption is to decrease the duration and magnitude of the gain. However, when the lower laser level and the ground level coincide, the resulting gain can be enhanced by this absorption. Comparison of the computer results shows reasonable agreement with other researchers' computer-predictions. A cross-referenced bibliography is provided to assist in further study of plasma lasers. Author (GRA)

N77-23481# Naval Electronics Lab. Center, San Diego, Calif.
EXTENDED LINE-OF-SIGHT OPTICAL COMMUNICATIONS STUDY Research and Development Report, 1 Jul. 1975 - 30 Jun. 1976
G. C. Mooradian, V. J. Adrian, P. H. Levine, and W. R. Stone 30 Jun. 1976 122 p refs
(AD-A034755; NELC-TR-1988) Avail: NTIS HC A06/MF A01 CSCL 17/2

The objective of this study was to carry out a tradeoff analysis among systems parameters for two types of extended line-of-sight optical communication links: optical forward scatter from the atmosphere and remotely piloted vehicle relay links. The general application of such links is the control of dispersed Naval task force units. An analytical model was developed for the optical scatter link and was found to be in reasonable agreement with limited field data. Author (GRA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N77-23482* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD OF FORMING SHRINK-FIT COMPRESSION SEAL Patent
Ted J. Podgorski, inventors (to NASA) (Honeywell, Inc., Minneapolis) Issued 19 Apr. 1977 5 p Filed 1 Apr. 1976 Supersedes N76-21558 (14 - 12, p 1533) Sponsored by NASA
(NASA-Case-LAR-11563-1; US-Patent-4,017,959; US-Patent-Appl-SN-672815; US-Patent-Class-29-447; US-Patent-Class-29-DIG.35; US-Patent-Class-53-9; US-Patent-Class-403-273) Avail: US Patent Office CSCL 13H

A method for making a glass-to-metal seal is described. A

domed metal enclosure having a machined seal ring is fitted to a glass post machined to a slight taper and to a desired surface finish. The metal part is then heated by induction in a vacuum. As the metal part heats and expands relative to the glass post, the metal seal ring, possessing a higher coefficient of expansion than the glass post, slides down the tapered post. Upon cooling, the seal ring crushes against the glass post forming the seal. The method results in a glass-to-metal seal possessing extremely good leak resistance, while the parts are kept clean and free of the contaminants. Official Gazette of the U.S. Patent Office

N77-23483* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMBINED DOCKING AND GRASPING DEVICE Patent
John L. Burch and James D. Johnston, inventors (to NASA) Issued 19 Apr. 1977 6 p Filed 7 Aug. 1975 Supersedes N75-29160 (13 - 20, p 2493)
(NASA-Case-MFS-23088-1; US-Patent-4,018,409; US-Patent-Appl-SN-602617; US-Patent-Class-244-161; US-Patent-Class-213-81; US-Patent-Class-214-1CM) Avail: US Patent Office CSCL 13I

A combined docking and grasping device for use with a manipulator arm on a docking vehicle and the like for mechanically connecting a docking vehicle with an orbital payload having a receptacle for receiving the device is described. The device includes a pair of opposing jaw members having opposing serrated surfaces for grasping an object and a triangular cam portion on an outer surface for insertion and interlocking with an orbital payload.
Official Gazette of the U.S. Patent Office

N77-23484 Wisconsin Univ., Madison.
MICRO-COMPUTER CONTROL SYSTEM FOR MACHINE TOOL DRIVE Ph.D. Thesis
John Mark Mills 1976 402 p
Avail: Univ. Microfilms Order No. 76-28163

A sampled data model is developed for open and closed loop response of the drive. Stability of response according to these models depends on the eigenvalues of a recursion matrix describing the sequence of sampled values of the drive's state variables: position, velocity, and acceleration. The completed control system functioned properly; it was tested for stability as a function of proportional feedback gain. Execution times of critical routines in the control program were measured directly. Duty cycle of the feedback control program was less than 20 percent at a sample rate of 100 Hz., suggesting that a single microprocessor could maintain control over three or more similar drives, with computation time remaining for essential supervisory functions in a computer numerical control system. Dissert. Abstr.

N77-23485 Wisconsin Univ., Madison.
THE DYNAMIC RESPONSE OF OVERHUNG GEARED SHAFT SYSTEMS IN TORSIONAL-LATERAL COUPLED VIBRATORY MODES Ph.D. Thesis
Michael Meng-Kao Wen 1976 168 p
Avail: Univ. Microfilms Order No. 76-28948

The foundation and basic structure of a gear system transfer matrix method for predicting the steady state coupled torsional-lateral dynamical behavior of actual multiple geared shaft systems is presented. By employing real matrices, natural frequencies, mode shapes, unbalanced response, and the response due to gear pitch diameter runout are readily calculated. The disk or gear is treated as a lumped mass with the effect of gyroscopic moment included. In addition to the properties of a disk, the gears involve the effect of the displacement relationship at the mesh and the potential excitation due to pitch diameter runout.
Dissert. Abstr.

N77-23486 Ernst-Mach-Inst., Freiburg (West Germany).
X-RAY STUDIES ON LENGTH REDUCTION OF PERFORATING RODS AT HIGH IMPACT VELOCITIES
V. Hohler and A. Stilp 1976 10 p refs
(Rept-4/76) Avail: Issuing Activity

The perforation mechanism of metal rods through different thick steel plates was investigated with multichannel flash radiography at velocities of up to 3.5 km/s. All rods were circular in cross section with a length to diameter ratio of 10; the masses varied between 1 and 10 grams; the rod material was steel. The perforation tests were carried out by means of a two-stage light-gas gun. Three stereo X-ray stations with orthogonal aligned tubes were used. The first X-ray station gives the orientation of the rod-projectile before perforation. The other two stations observe the orientation and the length and velocity reduction after the impact. These X-ray pictures also give information about the deformation of the rod, and the shape of the spray bubble around the rod. The experiments discussed were designed to check the validity of the hydrodynamic theory of rod penetration. The velocity-loss of the rods is very low for length reduction up to 80%; for higher reductions the residual velocity decreases very rapidly. The results verify the existence of a stationary phase and instationary phases at the beginning and end of the penetration. Author (ESA)

N77-23487*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CERAMIC APPLICATIONS IN THE ADVANCED STIRLING AUTOMOTIVE ENGINE
William A. Tomazic and James E. Cairelli 1977 13 p Presented at 5th Army Mater. Technol. Conf.: Ceramics for High Performance Appl., 2, Newport, R. I., 21-25 Mar. 1977; cosponsored by Army Mater. and Mech. Res. Center and DARPA
(Contract EC-77-A-31-1011)
(NASA-TM-X-73632; E-9131; ERDA/NASA-1011/77/2) Avail: NTIS HC A02/MF A01 CSCL 21A

The ideal cycle, its application to a practical machine, and the specific advantages of high efficiency, low emissions, multi-fuel capability, and low noise of the stirling engine are discussed. Certain portions of the Stirling engine must operate continuously at high temperature. Ceramics offer the potential of cost reduction and efficiency improvement for advanced engine applications. Potential applications for ceramics in Stirling engines, and some of the special problems pertinent to using ceramics in the Stirling engine are described. The research and technology program in ceramics which is planned to support the development of advanced Stirling engines is outlined. Author

N77-23488*# Rocketdyne, Canoga Park, Calif.
SMALL, HIGH-PRESSURE LIQUID HYDROGEN TURBOPUMP Final Report, Aug. 1973 - Apr. 1976
A. Csomor and R. Sutton 18 May 1977 278 p refs
(Contract NAS3-17794)
(NASA-CR-135186; R76-115) Avail: NTIS HC A13/MF A01 CSCL 13I

A high pressure, liquid hydrogen turbopump was designed, fabricated, and tested to a maximum speed of 9739 rad/s and a maximum pump discharge pressure of 2861 N/sq. cm. The approaches used in the analysis and design of the turbopump are described, and fabrication methods are discussed. Data obtained from gas generator tests, turbine performance calibration, and turbopump testing are presented. Author

N77-23489*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FRICTION AND WEAR OF SINTERED FIBER-METAL ABRADABLE SEAL MATERIALS
Robert C. Bill and Lawrence T. Shiembob (Pratt and Whitney Aircraft, East Hartford, Conn.) 1977 27 p refs Presented at 1977 Intern. Conf. on Wear of Materials, St. Louis, Mo., 25-28 Apr. 1977; sponsored by ASME
(NASA-TM-X-73650; E-9158) Avail: NTIS HC A03/MF A01 CSCL 11A

Three abradable gas path seal material systems based on a sintered NiCrAlY fibermetal structure were evaluated under a range of wear conditions representative of those likely to be encountered in various knife-edge seal (labyrinth or shrouded turbine) applications. Conditions leading to undesirable wear of the rotating knife were identified and a model was proposed based on thermal effects arising under different rub conditions. It was found, and predicted by the model, that low incursion (plunge) rates tended to promote smearing of the low density sintered material with consequent wear to the knife-edge. Tradeoffs benefits between baseline 19 percent dense material, a similar material of increased density, and a self lubricating coating applied to the 19 percent material were identified based on relative rub tolerance and erosion resistance. Author

N77-23490*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CERAMICS FOR THE ADVANCED AUTOMOTIVE GAS TURBINE ENGINE: A LOOK AT A SINGLE SHAFT DESIGN
Stanley M. Nosek 1977 12 p refs Presented at 5th Army Materials Technol. Conf. Ceramics for High Performance Applications, 2, Newport, R. I., 21-25 Mar. 1977; sponsored by AMMRC, ERDA, and DARPA
(NASA-TM-X-73651; E-9163) Avail: NTIS HC A02/MF A01 CSCL 21A

The results of a preliminary analysis of a single shaft regenerative design with a single stage radial turbine are presented to show the fuel economy that can be achieved at high turbine inlet temperatures, with this particular advanced design, if the turbine tip speed and regenerator inlet temperature are not limited. The engine size was 100 hp for application to a 3500 lb auto. The fuel economy was analyzed by coupling the engine to the auto through a continuously variable speed-ratio transmission and operating the system at constant turbine inlet temperature over the Composite Driving Cycle. The fuel was gasoline and the analysis was for a 85 F day. With a turbine inlet temperature of 2500 F the fuel economy was 26.2 mpg, an improvement of 18 percent over that of 22.3 mpg with a turbine inlet temperature of 1900 F. The turbine tip speed needed for best economy with the 2500 F engine was 2530 ft/sec. The regenerator temperature was approximately 2200 F at idle. Disk stresses were estimated for one single stage radial turbine and two two-stage radial-axial turbines and compared with maximum allowable stress curves estimated for a current ceramic material. Results show a need for higher Weibull Modulus, higher strength ceramics. Author

N77-23491*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INVESTIGATIONS FOR THE IMPROVEMENT OF SPACE SHUTTLE MAIN ENGINE ELECTRON BEAM WELDING EQUIPMENT
R. A. Smock, R. A. Taylor, and W. A. Wall Apr. 1977 23 p
(NASA-TM-X-73390) Avail: NTIS HC A02/MF A01 CSCL 13H

Progress made in the testing, evaluation, and correction of MSFC's 7.5 kW electron beam welder in support of space shuttle main engine component welding is summarized. The objective of this project was to locate and correct the deficiencies in the welder. Some 17 areas were deficient in the 7.5 kW ERI welding system and the associated corrective action was taken to improve its operational performance. An overall improvement of 20 times the original reliability was obtained at full rated capacity after the modifications were made. Author

N77-23492*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL STRESS ANALYSIS OF A GRADED ZIRCONIA/METAL GAS PATH SEAL SYSTEM FOR AIRCRAFT GAS TURBINE ENGINES
Christopher M. Taylor Apr. 1977 29 p refs
(NASA-TM-X-73658; E-9164) Avail: NTIS HC A03/MF A01 CSCL 21E

A ceramic/metallic aircraft gas turbine outer gas path seal designed to enable improved engine performance is studied. Flexible numerical analysis schemes suitable for the determination of transient temperature profiles and thermal stress distributions in the seal are outlined. An estimation of the stresses to which a test seal is subjected during simulated engine deceleration from sea level takeoff to idle conditions is made. Experimental evidence has indicated that the surface layer of the seal is probably subjected to excessive tensile stresses during cyclic temperature loading. This assertion is supported by the analytical results presented. Brief consideration is given to means of mitigating this adverse stressing. Author

N77-23493*# Boeing Commercial Airplane Co., Seattle, Wash.
TESTING OF POLYIMIDE SECOND-STAGE ROD SEALS FOR SINGLE-STATE APPLICATIONS IN ADVANCED AIRCRAFT HYDRAULIC SYSTEMS Final Report, Jul. 1976 - May 1977
A. W. Waterman May 1977 57 p refs
(Contract NAS3-18529)
(NASA-CR-135191; D6-44490) Avail: NTIS HC A04/MF A01 CSCL 11A

Machined polyimide second-stage rod seals were evaluated to determine their suitability for single-stage applications where full system pressure acts on the upstream side of the seal. The 6.35-cm (2.5-in.) K-section seal was tested in impulse screening tests where peak pressure was increased in 3.448-MPa (500-psi) increments each 20,000 cycles. Seal failure occurred at 37.92 MPa (5,500 psi), indicating a potential for acceptability in a 27.58-MPa (4,000-psi) system. Static pressurization for 600 sec at pressures in excess of 10.34 MPa (1,500 psi) revealed structural inadequacy of the seal cross section to resist fracture and extrusion. Endurance testing showed the seals capable of at least 65,000 1.27-cm (0.5-in.) cycles at 450 K (350 F) without leakage. It was concluded that the second-stage seals were proven to be exceptional in the 1.379-MPa (200-psi) applications for which they were designed, but polyimide material properties are not adequate for use in this design at pressure loading equivalent to that present in single-stage applications. Author

N77-23494*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FINITE-ELEMENT COMPUTER PROGRAM FOR AXISYMMETRIC LOADING SITUATIONS WHERE COMPONENTS MAY HAVE A RELATIVE INTERFERENCE FIT
Christopher M. Taylor (Leeds Univ., England) Washington May 1977 50 p refs
(NASA-TN-D-8483; E-9018) Avail: NTIS HC A03/MF A01 CSCL 20K

A finite element computer program which enables the analysis of distortions and stresses occurring in compounds having a relative interference is presented. The program is limited to situations in which the loading is axisymmetric. Loads arising from the interference fit(s) and external, inertial, and thermal loadings are accommodated. The components comprise several different homogeneous isotropic materials whose properties may be a function of temperature. An example illustrating the data input and program output is given. Author

N77-23495*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIFE ANALYSIS OF RESTORED AND REFURBISHED BEARINGS
John J. Coy, Erwin W. Zaretskiy, and Glen R. Cowgill Washington May 1977 19 p refs Prepared in cooperation with Army Air Mobility Res. and Devel. Lab., Cleveland
(NASA-TN-D-8486; E-8913) Avail: NTIS HC A02/MF A01 CSCL 13I

An analysis of the potential life of refurbished and restored bearings was performed. The sensitivity of 10-percent life and mean-time-between-failure to the effects of cumulative fatigue damage and the amount of stressed volume removed in the restoration process were examined. A modified Lundberg-Palmgren theory was used to predict that the expected 10-percent life of a restored bearing, which is dependent on the previous service time and the volume of material removed from the race surfaces, can be between 74 and 100 percent of the new bearing life. Using renewal theory, it is found that the mean time between failure ranged from 90 to 100 percent of that for a new bearing. Author

N77-23496# Bendix Corp., Kansas City, Mo.
CLOSED CIRCUIT TELEVISION WELDING ALIGNMENT SYSTEM
G. S. Darner Sep. 1976 14 p refs
(Contract E(29-1)-613)
(BDX-613-1533) Avail: NTIS HC A02/MF A01

Closed circuit television (CCTV) weld targeting systems were developed to provide accurate and repeatable positioning of the electrode of an electronic arc welder with respect to the parts being joined. A sliding mirror electrode holder was developed for use with closed circuit television equipment on existing weld fixturing. A complete motorized CCTV weld alignment system was developed to provide weld targeting for even the most critical positioning requirements. ERA

N77-23497# California Univ., Livermore. Lawrence Livermore Lab.

APPLICATIONS OF DIAMOND TURNING TO INFRARED OPTICAL SYSTEMS

F. E. Johnson and Theodore T. Saito 1976 8 p refs Presented at 20th Ann. SPIE Tech. Symp., San Diego, Calif., 26-27 Aug. 1976

(Contract W-7405-eng-48)

(UCRL-78697; Conf-760832-19) Avail: NTIS HC A02/MF A01

An initial survey of infrared sensor programs was conducted to predict the near term and future demand for diamond turned optical components. Not only does the fabrication process promise significant cost savings as compared to conventional lapping and polishing methods, but, as in the case of aspheric lenses, wider applications are also sought to reduce weight and space requirements. In addition, broader usage of diamond turned aspherics reduces total parts count and assembly and alignment time, provided proper tools and test equipment are employed. The potential cost savings of diamond turned vs conventionally-fabricated optics are summarized. The savings were calculated by subtracting the difference in fabrication costs and multiplying by the number of items expected to be produced into the mid-1980's. Technical fall-out potential of the diamond turning process is also noted in the apparent ability of a coated sample to pass a 24-hour salt fog test. ERA

N77-23498# Bendix Corp., Kansas City, Mo.

DESIGN MODIFICATION FOR HIGH VOLTAGE ELECTRON BEAM WELDING MACHINE

B. D. Fricke Sep. 1976 21 p

(Contract E(29-1)-613)

(BDX-613-1488; PDO-6984748) Avail: NTIS HC A02/MF A01

High voltage electron beam welding equipment control problems affecting weld penetration, weld width, and machine utilization have been experienced when power requirements are less than 5 percent of rated capacity. Design modifications for these machines were developed to improve their performance when beam current requirements are less than 6 mA and to achieve control of multiple machines by a single computer. Modification of one production machine has been completed. Future equipment activities include modifying two additional production machines to the developed design and establishing computer control of both a laboratory machine and the production machines. ERA

N77-23499# GARD, Inc., Niles, Ill.

INSPECTION OF NUCLEAR REACTOR WELDING BY ACOUSTIC EMISSION Data Report, Nov. 1975 - May 1976

D. W. Prine Jul. 1976 29 p refs Sponsored by NASA

(NUREG-0035-2) Avail: NTIS HC A03/MF A01

Experimental acoustic emission data on simulated nuclear pressure vessel welds are presented. Acoustic emission was monitored during the pressure vessel tests using flaw detection and noise discrimination techniques previously applied to nuclear piping welds. In addition to the flaw detection circuitry, a modified Dunegan-Endevco two-channel time-of-arrival flaw location system was utilized. Acoustic emission data are considered in terms of the capability of AE to discriminate between various flaw types and to provide information on flaw size. The results of the analysis are compared to current ASME Code requirements to determine those areas where additional laboratory testing is required. ERA

N77-23500# California Univ., Livermore. Lawrence Livermore Lab.

LONG-ROD PROJECTILES AGAINST OBLIQUE TARGETS: ANALYSIS AND DESIGN RECOMMENDATIONS

D. M. Norris, W. H. McMaster, and M. L. Wilkins 16 Apr. 1976 34 p refs

(Contract W-7405-eng-48)

(UCRL-52057) Avail: NTIS HC A03/MF A01

Computer calculations provide an understanding of impact phenomena associated with long rod penetrators striking targets at oblique angles. The rod and target material behaviors are described by elastic-plastic work-hardening constitutive models. Ductile fracture is simulated by setting all tensile and shear stresses to zero when the calculated plastic deformation reaches a critical value. The important penetration material properties to defeat a given target are identified. Experimental results are presented to demonstrate the effects of ductility and toughness on penetration performance. ERA

N77-23501# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Construction Metallique.

FRICTION WELDING OF SUPERHEATER PIPES

Jan Peirtsegaele and Joris Decock Nov. 1976 43 p refs Sponsored by Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.

(CRIF-MT-115) Avail: NTIS HC A03/MF A01

The possibility of using friction welding for welding superheater pipes was studied. To begin with, the welding process is described together with the welding parameters, which influence the quality of the joint. The test results of research carried out on a large number of butt welded pipes are then presented. Both homogeneous and heterogeneous joints were included in the study. From the results it appears that as far as fatigue is concerned, a friction weld gives rise to very good results; however, with regard to creep it was found that the friction welds show a rather poor capability of deformation and more experimental tests must be carried out. The tests also indicate a narrow heat affected zone and a relatively small increase in hardness. The welding of heterogeneous materials by friction does not pose any particular problems. Author (ESA)

N77-23502# Brussels Univ. (Belgium). Inst. of Applied Mechanics.

STUDY AND REALIZATION OF A FLUIDIC DEVICE FOR AUTOMATIC STARTING AND STOPPING OF A GAS TURBINE [ETUDE ET REALISATION D'UN DISPOSITIF FLUIDIQUE DE DEMARRAGE ET D'ARRET AUTOMATIQUES D'UNE TURBINE A GAZ]

Andre deGoeyse 1975 41 p refs In FRENCH

(NT-37-1075) Avail: NTIS HC A03/MF A01

An automatic system for starting and stopping a gas turbine using fluidic elements is described. The system allows testing the operation of all the logic circuits and control before turbine startup. Operational failures during starting and stopping phases are detected just as during normal operation. Wall effect fluidic elements were employed for two reasons: systems reliability and product development. A fluidic rotational velocity sensor was also developed. ESA

N77-23503# Royal Aircraft Establishment, Farnborough (England).

METAL SEALS. RESULTS OF A THEORETICAL AND EXPERIMENTAL STUDY OF THEIR ELASTOHYDRODYNAMIC LUBRICATION

L. E. C. Ruskell 9 Jun. 1976 95 p refs

(RAE-TR-76070; BR53653) Avail: NTIS HC A05/MF A01

An experimental and theoretical study of elastohydrodynamic lubrication in reciprocating metal seals is presented. Their lubrication was not satisfactory under all conditions, and the aim was to gain a fundamental understanding of the hydrodynamic conditions between the seal and counterface to determine why this was so. A rig was constructed which allowed simultaneous measurement of pressure distribution and film shape under a seal. On the theoretical side, solutions of the elastohydrodynamic equations are given and compared with the experimental results. The physical factors responsible for the unsatisfactory behavior of the seals are discussed; some suggestions are made as to how these might be overcome. Author (ESA)

N77-23504# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

EXPERIMENTAL AEROELASTIC INVESTIGATIONS ON A CASCADE IN COMPRESSIBLE FLOW

Peter Bublitz 11 Nov. 1976 24 p refs Sponsored by Kraftwerk-Union Muelheim

(DLR-FB-76-60) Avail: NTIS HC A02/MF A01; DFVLR, Cologne DM 13.80

Violent oscillations occurring in the last stage of a large

steam turbine were investigated. Experiments were carried out on an elastomechanically similar test cascade in three-dimensional compressible flow in a wind tunnel. The test arrangement is described and the results are presented. The tests revealed that the occurrence of oscillations is related to a reduction of the mass flow relative to the design point. Throttling the mass flow successfully provokes buffeting, sudden displacement of the steady mean position of the blades due to the instability of the shocks, and finally stall. Schlieren pictures and a high speed moving schlieren film give an insight into the fluid mechanical and the aeroelastic phenomena. Author (ESA)

N77-23505# AiResearch Mfg. Co., Torrance, Calif.
LINEAR INDUCTION MOTOR RESEARCH VEHICLE SPEED UPGRADING TESTS (190 TO 250 MPH) Final Report, 26 Mar. - 14 Aug. 1974
C. C. Chi Jun. 1976 105 p refs
(Contract DOT-FR-30026)
(PB-261852/8; AiResearch-74-11035-Rev-1; FRA/ORD-76-268) Avail: NTIS HC A06/MF A01 CSCL 13F

The linear induction motor research vehicle (LIMRV) was subjected to a series of test runs at speeds of 190 to 250 mph. High-speed dynamic performance data on the vehicle, trucks, suspension systems, and LIM guidance system were acquired by means of instrumentation that measured accelerations and displacements. For these tests the LIMRV was fitted with two jet engines. Sufficient data were collected so that a safe LIMRV operating profile could be constructed as a baseline for conducting LIM electrical performance tests with full confidence in the vehicle's dynamic stability up to its design speed of 250 mph. GRA

N77-23506# AiResearch Mfg. Co., Torrance, Calif.
LINEAR INDUCTION MOTOR RESEARCH VEHICLE WHEEL/RAIL ADHESION TEST Final Report, Dec. 1974 - Jun. 1975
R. P. Chen and G. O. DSena Apr. 1976 62 p refs
(Contract DOT-FR-40016)
(PB-261853/6; AiResearch-75-11970-Rev-1; FRA/ORD-76-261) Avail: NTIS HC A04/MF A01 CSCL 13F

The wheel/rail adhesion with increasing vehicle speed was investigated. The results obtained are qualitatively compatible with published data on moderate-speed tests; at high speeds, however, degradation of the attainable adhesion coefficient was not apparent. This test program indicates that wheel/rail adhesion may not limit the maximum safe speed of wheel/rail vehicles to the degree previously assumed. It is also evident that for the LIMRV, which has a higher speed capability and apparently a larger attainable wheel/rail adhesion coefficient than a conventional vehicle, the running rail surface exerts a more pronounced effect on the maximum attainable adhesion than does vehicle speed. GRA

N77-23507# Transportation Systems Center, Cambridge, Mass.
THE 1975 AUTOMOTIVE CHARACTERISTICS DATA BASE Final Report, Jun. 1975 - 1976
Moses Rouse and William Basham Oct. 1976 136 p Sponsored by DOT
(PB-262015/1; DOT-TSC-OST-76-27) Avail: NTIS HC A07/MF A01 CSCL 13F

Automobile characteristics as a supportive tool for auto energy consumption, fuel economy monitoring, and fleet analysis studies are presented. The methods of vehicle sample selection, computation methods for statistical reports, illustrative output examples, and instructions for operating the data base are presented to fully represent the 1975 automobile fleet characteristics. GRA

N77-23508# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
EXPLORATORY RESEARCH IN INDUSTRIAL MODULAR ASSEMBLY Progress Report, 1 Sep. 1975 - 31 Aug. 1976
J. Nevins, D. Whitney, S. Drake, D. Killoran, and A. Kondoleon 30 Aug. 1976 177 p refs
(Grants NSF ATA-74-18173-A01; NSF GI-43787)
(PB-260677/0; NSF/RA-760267; Rept-4) Avail: NTIS HC A09/MF A01 CSCL 13H

Some accomplishments achieved during the current year include: (1) complete geometric analysis of single insertion tasks and screw thread mating; (2) the first fully instrumented single insertion tests, which yielded clear and unambiguous force-torque data indicating what initial errors existed between the pieces; (3) correlation of the experimental data and the geometric and force-friction theories developed earlier; and (4) design of three varieties of compliant wrists capable of allowing very close clearance insertions with low contact forces and large initial errors. GRA

N77-23509# Massachusetts Inst. of Tech., Cambridge.
THE MIT/MARINE INDUSTRY COLLEGIUM. OPPORTUNITY BRIEF NO. 4: ADVANCES IN UNDERWATER WELDING
15 Aug. 1976 30 p refs Sponsored in part by NOAA, Washington, D. C.
(PB-262560/6; MITSG-76-8; NOAA-76112421; Opportunity Brief 4) Avail: NTIS HC A03/MF A01 CSCL 13H

The needs and the potential for underwater welding are outlined, and some current techniques are listed. There is an existing need for technology that permits permanent, code quality welding underwater. The need grows out of the increasing numbers of offshore structures that require repair from time to time. Further, if such technology were available, the construction industry could take advantage of certain procedures in building offshore structures. Additional advances appear at hand. Existing methods of underwater welding and the directions of current research that show promising potential are reported. GRA

N77-23510# Brush Wellman, Inc., Cleveland, Ohio.
PRODUCTION ENGINEERING MEASURES TO MANUFACTURE SUPER FINE FINISH BERYLLIA Final Report, 30 Jun. 1974 - 22 Sep. 1976
Kenneth A. Walsh 12 Oct. 1976 79 p refs
(Contract DAAB07-74-C-0606)
(AD-A032433; BW-TR-582) Avail: NTIS HC A05/MF A01 CSCL 13/8

A progressive polishing process was developed to reduce the roughness of the working surface of beryllia substrates to less than four microinches center line average. Commercially available 1 inch x 1 inch and 2 inch x 2 inch beryllia plates containing 99.5 percent beryllia served as the input material. To minimize warpage, one face of the beryllia plate was machined on a polishing wheel charged with six micron diamond paste. The opposite or working surface was polished on the same wheel to a surface finish of 5-8 microinches. The cleaned working surface was final polished on a polishing wheel charged with three micron diamond paste. Scale-up from a twelve inch diameter laboratory polisher to a twenty-four inch diameter manufacturing unit was demonstrated. Dicing was used to produce small 0.080 inch x 0.110 inch substrates from polished 1.0 inch x 1.0 inch plates. A Pilot Run demonstration achieved the production rate goal of 1000 substrates per week for each of three sizes of beryllia substrates. Author (GRA)

N77-23511# Naval Civil Engineering Lab., Port Hueneme, Calif.
EVALUATION OF TOTALLY ENCLOSED ELASTOMERIC BEARING AS A HINGE JOINT BASE OF GUYED VLF TOWER Final Report, Dec. 1974 - Nov. 1975
G. Warren Nov. 1976 45 p refs
(AD-A033482; CEL-TN-1461) Avail: NTIS HC A03/MF A01 CSCL 13/13

The Civil Engineering Laboratory (CEL) has conducted an evaluation of a totally encased elastomeric bearing as a hinge bearing joint at the base of large guyed VLF towers. The test program included laboratory evaluation of a bearing from Andre Rubber Company Limited, as well as a CEL-fabricated bearing; field measurements of tower base movements at Annapolis, Maryland; and finite element analysis of bearing components. Results indicate that encased elastomeric bearings similar to the Andre bearing are suitable for use as base hinges. Geometric modifications of the steel components must be made to reduce contact stresses during application of horizontal shear loads from the tower. In addition, special precaution must be taken to ensure that the elastomer is properly lubricated and is isolated from oxidation and ozone attack. Author (GRA)

N77-23512# Rockwell International Science Center, Thousand Oaks, Calif. Science Center.

FUNDAMENTALS OF PLASMA ARC WELDING Annual Report, 1 Apr. 1975 - 31 Mar. 1976
C. B. Shaw, Jr., B. I. Davis, and D. W. Trover Oct. 1976 45 p refs
(Contract N00014-75-C-0789)
(AD-A032442; SC5031.7AR; AR-1) Avail: NTIS HC A03/MF A01 CSCL 13/8

This new project seeks to aid development of the plasma-arc welding (PAW) process by studying it as a problem in applied physics. The importance and difficulty of welding-plasma temperature measurements are indicated. New experimental and analytical methods for measurement of asymmetric plasmas are described. Continuum radiation is reported to be much stronger relative to spectral line radiation for small-standoff PAW than for either long-standoff PAW or for gas tungsten arc-welding. This can impair temperature measurement by the two-wavelength method of emission spectroscopy, but plans are given for circumventing the difficulty and correlating systematic plasma temperature-distribution measurements with welding parameters and weld quality. Author (GRA)

N77-23513# Army Construction Engineering Research Lab., Champaign, Ill.
DETERMINATION OF ARC VOLTAGE, AMPERAGE, AND TRAVEL SPEED LIMITS BY BEAD-ON-PLATE WELDING Final Report
R. A. Weber Dec. 1976 24 p refs
(DA Proj. 4A7-62731-AT-41)
(AD-A033684; CERL-TR-M-197) Avail: NTIS HC A02/MF A01 CSCL 13/8

This report presents the results of bean-on-plate tests to define limits for voltage, amperage, and travel speed. The work was divided into two sections: shielded metal-arc welding (SMAW) and gas metal-arc welding (GMAW). The limits for voltage and travel speed were determined for SMAW electrodes based on limits previously determined by the American Welding Society (Specification A5.1-69). Voltage and amperage limits for GMAW electrodes were determined based on types of metal transfer; travel speed limits were based on bead appearance and shape. The results of this research are not final; further work on butt welds will refine the limits. The final results will be used to prepare recommended changes to appropriate guide specifications and technical manuals. Author (GRA)

N77-23514# Naval Ship Research and Development Center, Bethesda, Md.
THE SWING-PAD BEARING: A NEW CONCEPT IN SLIDING-SURFACE BEARINGS
J. Greene Jan. 1977 41 p refs
(SF54543501; SF54543706)
(AD-A034891; DTNSRDC-76-0055) Avail: NTIS HC A03/MF A01 CSCL 13/9

This report introduces a new bearing concept, the swing-pad bearing. The concept is a sliding-surface lubricated bearing in which the stationary bearing surface is segmented into pads that can displace through a motion resembling a swing to form a wedge-shape converging in the direction of motion with the rotating member. Viscous friction force moments are in the direction to form the converging wedge-shape; fluid pressure force moments oppose wedge formation. The pad bearing surface stabilizes at a position where these moments are in balance. Exploratory experimental investigations conducted on model elastomer surface swing-pad bearings indicate exceptional performance characteristics. These characteristics are: (1) low coefficients of friction representative of fluid lubrication under load/speed/fluid viscosity combinations that would produce boundary lubrication in conventional bearings; (2) operation at rotational start-up and at extremely low speeds with applied loads that would cause stick-slip motion and squeal in conventional bearings. Author (GRA)

N77-23515# Norton Co., Worcester, Mass. Industrial Ceramics Div.
GRINDING OF SILICON NITRIDE TURBINE BLADE SHAPES Final Report, Nov. 1975 - May 1976
Spencer H. Baker Jun. 1976 22 p
(Contract DAAG46-76-C-0024; DA Proj. 1T1-62105-AH-84)
(AD-A034757; AMMRC-CTR-76-16) Avail: NTIS HC A02/MF A01 CSCL 13/8

The objectives of this research program were to develop machining techniques which could be used to grind a small, one piece gas turbine rotor out of a fully densified silicon nitride blank. Metal bonded diamond cup wheels and mounted points were used to drive abrasive slurries in accomplishing the machining. A few sample blades of fair quality were machined using the mounted point system, but the stock removal rate was found to be too low to be commercially feasible. Author (GRA)

N77-23516# Army Materials and Mechanics Research Center, Watertown, Mass.
PARALLEL AND INTERSECTING WELDS IN HIGH-STRENGTH STEEL SHEET Final Report
Donald C. Buffum Dec. 1976 20 p refs
(AD-A034169; AMMRC-TR-76-42) Avail: NTIS HC A02/MF A01 CSCL 13/5

The objective of this project was to determine interaction effects of parallel and intersecting welds in high-strength steel sheet as well as to determine the need for excessive buildup of the welded area. Included are the effects of minor variables in welding upon the weldments. The alloys used in the project were 4130, 4340, and 18% Ni maraging steel sheet. The joining process was gas tungsten arc welding. Author (GRA)

N77-23517# Abex Corp., Mahwah, N. J. Research Center.
MACHINE CASTING OF FERROUS ALLOYS Final Report, 1 Feb. 1973 - 30 Sep. 1975
H. R. Larson, B. A. Heyer, and C. P. Biswas Aug. 1976 97 p refs
(Contract DAAG46-73-C-0113; ARPA Order 2267)
(AD-A034198; AMMRC-CTR-76-25) Avail: NTIS HC A05/MF A01 CSCL 13/9

An experimental ferrous casting machine of 20 lbs. capacity was designed and constructed to evaluate rheocasting and conventional casting processes. This machine is a bottom-pour furnace in which the transfer of the metal 'slurry' to the mold was accomplished by pressurizing the furnace chamber and retracting a stopper rod. The melting and casting operation took place entirely under an inert atmosphere at low positive pressure to minimize slag formation. Several experimental models of both conduction and induction type MHD valves were made and it has been demonstrated that some lift can be obtained from these MHD devices to hold the bulk metal and to control its flow but a much stronger lift force would be required for any practical casting machine. Protective coatings for graphite were studied. GRA

N77-23518# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
FEDERAL SUPPORT FOR THE DEVELOPMENT OF ALTERNATIVE AUTOMOTIVE POWER SYSTEMS: THE GENERAL ISSUE AND THE STIRLING, DIESEL, AND ELECTRIC CASES Final Report, 1 Nov. 1974 - 30 Nov. 1975
Lawrence H. Linden, John B. Heywood, H. D. Vacoby, and Howard Margolis Mar. 1976 406 p refs
(Grants NSF OEP-74-21320; NSF EN-44166)
(PB-263523/3; MIT-EL-76-014; NSF/PRA-7421320-1-6) Avail: NTIS HC A18/MF A01 CSCL 21G

The federal government's role in supporting alternative automotive powerplant R and D for the explicit purpose of advancing the state-of-the-art is examined. An examination of the process by which major product technology changes occur in the automotive industry is reviewed. The automotive market is then examined for divergences between private and social costs and benefits, especially with respect to air pollution and fuel economy. Next the nature of the cost benefit analysis problem is discussed. Finally, three specific technologies are examined in detail and recommendations made as to government supported R and D for each. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N77-23519 Missouri Univ., Rolla.
RELIABILITY GROWTH APPORTIONMENT Ph.D. Thesis
Donald Henry Galli 1976 95 p
Avail: Univ. Microfilms Order No. 77-5568

A method is presented for apportioning reliability growth to the various subsystems that make up a series system. Reliability growth apportionment is handled as an expected cost minimization problem subject to the constraint of meeting a system reliability requirement. The problem is formulated in terms of the Weibull reliability growth model, and is solved using geometric programming. A similar problem for parallel-series systems is solved using generalized geometric programming. Also, a heuristic method of assigning optimal reliability growth and redundancy to each stage of a parallel-series system is presented. Dissert. Abstr.

N77-23520# Danish Research Center for Applied Electronics, Hoersholm.
PRODUCT ASSURANCE PROGRAMME PLAN FOR HIGH RELIABILITY PRODUCTS
E. Andersen Feb. 1976 68 p refs
(ECR-59) Avail: NTIS HC A04/MF A01

The product assurance provisions pertinent to the design, fabrication, test, and delivery of high reliability equipment are established and presented. Author

N77-23521# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
QUANTITATIVE SAFETY ANALYSIS, 2
L. M. Arnett Sep. 1976 24 p refs
(Contract E(07-2)-1)
(DP-1420) Avail: NTIS HC A02/MF A01

Several examples of probabilistic models often used to analyze fault trees, common mode failures, and decision trees are discussed to show that each is a special case of a general model. Experience with this method of analysis over the past few years has shown that the generality originally incorporated in the method may have obscured its real usefulness. Many types of real life situations (fault trees, event trees, decision trees, and common mode failures) are special cases. The numerical answer that results from the analysis of any one of these special cases is not likely to be as accurate as a single number implies. The content and extent of the analysis are more important than the single numerical answer. ERA

N77-23522# Chemical Lab. RVO-TNO, Rijswikj (Netherlands).
NON-DESTRUCTIVE TEST FOR CHARCOAL FILTERS. PART 4: THE DETERMINATION OF THE RESIDUAL ADSORPTION CAPACITY AND THE WATERCONTENT OF CHARCOAL BEDS Final Report
P. G. J. Koopman and P. C. Stamperius Dec. 1975 29 p refs
(Contract A74/K/027)
(CL-1975-29; TDCK-67592) Avail: NTIS HC A03/MF A01

The method investigated for the nondestructive determination of the residual adsorption capacity of charcoal beds and for the leak testing of gas filters filled with charcoal, consists of the determination of the changes in the shape of the eluted peak of a strongly adsorbed compound (bromobutane) administered at the entrance of the filter as a pulse. The influence of toxic adsorbed material on the changes in peak shape appeared to be negligible compared to the influence due to the water adsorption at relative humidities of 50% and higher. A method was also studied for the determination of the water content of charcoal beds by psychrometric measurements. This method turned out to be of use only in the rare case that the water content of the charcoal is in equilibrium with the matching relative humidity. Both investigated methods failed to give prospects for the determination of the residual gas life of charcoal filters. Author (ESA)

N77-23523# Naval Postgraduate School, Monterey, Calif.
A COMPARISON OF THE LIEBERMAN-ROSS AND MANN-GRUBBS METHOD Final Report, Jul. - Sep. 1976
Arthur L. Schoenstadt Sep. 1976 26 p refs
(AD-A032655; NPS-53ZH76091) Avail: NTIS HC A03/MF A01 CSCL 14/4

This paper compares the Lieberman-Ross (LR) method, a statistically exact procedure for computing system reliability bounds, with the Mann-Grubbs (MG) procedure, an approximately optimum method for computing such bounds. For systems with exponentially distributed failure times, it is shown that the MG procedure, using the same data as the LR procedure, will always compute a lower bound than the LR bound. Simulation methods are used to infer that only when failure data are ordered so that a significant portion of the data is not incorporated by the LR procedure, will the LR procedure have a reasonable expectation of producing a superior bound to the MG bound. This is interpreted as dictating a data order that discards failure data on the least reliable component samples. GRA

N77-23524# Oklahoma State Univ., Stillwater. Fluid Power Research Center.
MERDC/OSU HYDRAULIC SYSTEM RELIABILITY PROGRAM Annual Report, Feb. 1975 - Feb. 1976
Feb. 1976 447 p refs
(Contract DAAK02-75-C-0137)
(AD-A032642; OSU-FPRC-6M1) Avail: NTIS HC A19/MF A01 CSCL 13/7

Contents: Structural Analysis of Cylinders; Hydraulic Noise; Hydraulic System Diagnostics; Lube Oil Filter Study for Mobile on-off Highway Diesel Engine Driven Vehicles-2; On-Board Monitor Study; Pump Contaminant Tolerance Verification; and Piston Pump Specification Development Project. GRA

N77-23525# Lockheed Electronics Co., Plainfield, N. J.
THE DYNAMIC MEASUREMENT AND FUNCTIONAL INSPECTION OF SOLDER JOINTS Final Report, Phase 1
15 Dec. 1976 169 p refs
(Contract DAAA21-76-C-0100)
(AD-A034852; PA-TR-5005) Avail: NTIS HC A08/MF A01 CSCL 13/5

The study evaluated the effectiveness of nondestructive and dynamic measurement techniques for determining the quality and reliability of solder joints when compared to the presently used method of visually inspecting solder joints for cosmetic appearance. The study concludes that inspection cost can be reduced and the reliability of solder joints can be best assured by quantitatively controlling soldering processes. GRA

N77-23526# Northrop Corp., Hawthorne, Calif. Aircraft Div.
CHARACTERIZATION OF SURFACES PRIOR TO ADHESIVE BONDING Final Report, 15 Mar. 1975 - 15 Mar. 1976
T. P. Remmel Jul. 1976 95 p refs
(Contract F33615-75-C-5143)
(AD-A034826; NOR-76-58; AFML-TR-76-118) Avail: NTIS HC A05/MF A01 CSCL 13/8

The objective of this program was to develop procedures for the quality control of anodized surfaces on aluminum alloys prior to bonding. The scanning electron microscope (SEM) was selected as the inspection instrument. Both phosphoric and chromic acid anodizing systems were included in the initial phases of this program. The character of these anodic surface coatings was evaluated on both bare and clad 7075-T6 in terms of physical, chemical, and crystallographic nature. Anodic coatings were found to be composed of a porous oxide layer of the boehmite or alpha-Al2O3.H2O crystallographic form. Panels anodized on both the PABST (Primary Adhesively Bonded Structures Technology) program at McDonnell Douglas and Phase II of 'Characterization of Surface Prior to Adhesive Bonding' at Rockwell Science Center, exhibited oxide coatings of similar character. The dependence of the anodic film character on the various anodizing parameters was determined for the phosphoric acid anodizing of bare 7075-T6. Included in this investigation were anodizing variables such as voltage, time, bath concentration, Pretreatment prior to anodizing, and postanodize rinsing. Both thickness and cell size of the oxide layer were found to vary almost linearly with the anodizing voltage and parabolically with anodizing time. The oxide character was also

found to vary with the concentration of the anodizing bath, with an increase in bath concentration resulting in increases in both oxide thickness and cell size. The anodic surface character determined by SEM inspection prior to adhesive bonding was correlated with the wedge test durability behavior of the bonded surface. GRA

N77-23527# Raytheon Co., Waltham, Mass. Research Div.
MANUFACTURING METHODS AND TECHNOLOGY MEASURE FOR ARC PLASMA SPRAYED PHASE SHIFTER ELEMENTS Quarterly Progress Report, 1 Jul. - 30 Sep. 1976
H. J. VanHook, D. Masse, and J. Saunders Oct. 1976 44 p (Contract DAAB07-75-C-0043)
(AD-A034794; S-2112; QPR-5) HC A03/MF A01 CSCL 09/5

Data on plasma spray parameters are given for 108 samples sprayed during this quarter. A new holding furnace and solenoid activated controls for sample translation are the major equipment changes that have been carried out this quarter. Several different ferrite powders and a number of dielectric compositions were investigated. Cracks in the ferrite layer, although reduced in number, are found in most samples. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N77-23528 Connecticut Univ., Storrs.
THE INFLUENCE OF GEOMETRIC IMPERFECTIONS ON THE FREE VIBRATIONS OF THIN CYLINDRICAL SHELLS Ph.D. Thesis
Shrikant Triuikram Bhat 1976 164 p
Avail: Univ. Microfilms Order No. 77-4250

A relatively thin - small thickness to radius ratio - ring and cylindrical shell were investigated to numerically evaluate the effect of eccentricity on the first four nontrivial natural frequencies and corresponding mode shapes. The thin shell is assumed to be freely supported at the ends whereas the boundary conditions for thin ring allow it to be freely supported in space and is free to translate and rotate with rigid body motion. The mode shape coupling is relatively weak in thin rings for small eccentricity ratio. The shell results depend strongly on the axial wavelength parameter. The shell which was investigated independently of thin ring analysis shows results similar to the latter under extreme parametric ratios. The node point also shifts from its position depending on the mode configuration and magnitude of eccentricity ratio. Dissert. Abstr.

N77-23529 Carnegie-Mellon Univ., Pittsburgh, Pa.
WAVE PROPAGATION CHARACTERISTICS AND ATTENUATION PREDICTION IN AN AXISYMMETRIC MULTILAYERED ELASTIC-VISCOELASTIC SUPPORT MEMBER Ph.D. Thesis
Robert John Powischill 1976 158 p
Avail: Univ. Microfilms Order No. 77-5030

Acoustical wave transmission in a simple structure is investigated to predict wave characteristics by analytical means. Pochhammer-Chree theory has been used to formulate an axisymmetric model to determine wave propagation characteristics with respect to pertinent parameters. It was postulated that the overall acoustical transmission characteristics in an elastic or viscoelastic multi layered bar can be modified within limits if selected mode-shapes are altered. Dissert. Abstr.

N77-23530 California Univ., Berkeley.
AN INTERNAL VARIABLE THEORY OF PLASTICITY BASED ON DISLOCATION MECHANICS Ph.D. Thesis
Roger Wayne Werne 1976 157 p
Avail: Univ. Microfilms Order No. 77-4648

For isotropic materials, a representation theorem is used to express the dislocation velocity vector in terms of the dislocation density and the macroscopic state of stress. It is shown that under the condition of plastic incompressibility, the octahedral shear planes of the stress tensor are the glide planes for dislocation motion. Thus the total rate of plastic deformation is obtained by summing the dislocation motion over the eight octahedral shear planes of the stress tensor. The resulting theory yields an elastic-viscoplastic material behavior and is incorporated as a constitutive subroutine in a finite element code. Several problems, including a uniaxial tensile specimen, a thick-walled cylinder, and plane strain wave propagation, are solved which demonstrate the range of material behavior. Dissert. Abstr.

N77-23531 Delaware Univ., Newark.
SURFACE EFFECTS IN FATIGUE CRACK NUCLEATION Ph.D. Thesis
Ankur Purohit 1976 265 p
Avail: Univ. Microfilms Order No. 77-4229

The fatigue life on the surface region of copper, brass, and copper-nickel alloys was investigated. The variables manipulated were stacking fault energy, elastic moduli, lattice misfit, and surface topography for reversed bending and fluctuating tension tests. The results indicated that fatigue life is inversely related to stacking fault energy, when elastic moduli, lattice misfit and surface topography are controlled and positively related to elastic moduli and lattice misfit. Further, it was speculated that diffusional pits formed affect surface topography and may decrease fatigue life. Dissert. Abstr.

N77-23532 California Univ., Berkeley.
PARAMETRIC INSTABILITY AND LIMIT CYCLE RESPONSE OF NONLINEAR ELASTIC SHELLS Ph.D. Thesis
Lingagold Memula 1976 83 p
Avail: Univ. Microfilms Order No. 77-4535

The stability of symmetrical motion of spherical shells under racial perturbation is investigated. The symmetrical motion consists of a constant finite deformation plus a harmonic motion of small amplitude. The perturbation equation governing the stability of spherical shells in radial mode is obtained directly from the nonlinear equations of motion of the perturbed state. In the case of thin spherical shells the perturbation equation reduces to Mathieu equation for which the unstable regions are completely known. The primary instability regions are then determined for thin spherical shell. In the case of spherical shells which are not necessarily thin the perturbation equation is a general second order differential equation with periodic coefficients and a small parameter. Dissert. Abstr.

N77-23533 California Univ., Berkeley.
NONLINEAR TRANSIENT DYNAMIC ANALYSIS OF YIELDING STRUCTURES Ph.D. Thesis
Haluk Oezdemir 1976 227 p
Avail: Univ. Microfilms Order No. 77-4564

In an attempt to describe force-deformation behavior of energy absorbers, three mathematical models are presented, all taking the form of rate-type evolutionary equations and utilizing internal variables. The first is a rate-dependent model derived on the physical basis of plastic deformations, and lends itself naturally to a constant-stiffness approach. It is shown that this model can be used to incorporate nonlinear hardening and is applicable under random dynamic loading without resorting to complimentary rules. The rate-independent model is derived from the rate-dependent model and provides a more accurate representation of the behavior of energy-absorbers; however, its effective implementation requires a variable stiffness approach. The rate-independent equations are then further developed to model the deteriorating absorbing capacity of these devices under continued cycling. Dissert. Abstr.

N77-23534 Connecticut Univ., Storrs.
MULTIDIMENSIONAL ORTHOGONAL TRANSFORMATIONS FOR THE SOLUTION OF THE EIGENPROBLEM OF THE REAL SYMMETRIC MATRIX Ph.D. Thesis
Suresh Ramkrishna Phansalkar 1976 244 p
Avail: Univ. Microfilms Order No. 77-4290

The first strategy is a direct generalization of the two dimensional orthogonal transformations (plane rotations) used in the Jacobi method, to a higher dimension b. to be determined optimally. The second strategy considered develops a new

technique to obtain satisfactory approximations to a selective number of eigenpairs of a general, real, symmetric matrix of order n, with an effort proportional to square n, rather that cubic n, for large n. The given matrix a sub n is reduced by means of m minimization sweeps using plane rotations, to the bordered diagonal form B sub n with m levels in the border, with its leading principal minor B sub n-m in diagonal form for all practical purposes. Conditions under which B sub n admits of multiple eigenvalues have been examined. A new method for accurately computing the orthogonal eigenvectors corresponding to a multiple eigenvalue is developed, and is an improvement over inverse iteration. Dissert. Abstr.

N77-23535 Missouri Univ., Rolla.
ANALYSIS OF THICK-WALLED BOURDON TUBES Ph.D. Thesis
Robert Charles Weber 1976 242 p
Avail: Univ. Microfilms Order No. 77-5560

Numerical analysis was conducted using a finite element approach. A generation program, to describe the geometry of the tube, was written and adapted to Dr. E. ,L. Wilson's Solid Sap finite element program. The experimental work was conducted by measuring the tip deflection of the Bourdon Tubes at various pressures. The primary experimental variables were: (1) cross section of the tube, (2) internal tube pressure, (3) bend radius of the tube; and (4) length of the tube. The tip deflection was measured using two mutually perpendicular dial gages mounted on a rigid frame. Dissert. Abstr.

N77-23536# Aeronautical Research Labs., Melbourne (Australia).
A FINITE ELEMENT METHOD FOR CALCULATING STRESS INTENSITY FACTORS IN CRACKED SHEETS
R. Jones and R. J. Callinan Jan. 1976 15 p refs
(ARL/Struc-Rept-360) Avail: NTIS HC A02/MF A01

The stress intensity factor in a cracked sheet was studied using a finite element method. A special element is placed around each crack tip; in each special element the stresses and displacements are derived from Airy's stress function while the continuity of displacements at the nodes is satisfied in a least squares sense. Both the size of the special element and the number of terms in the series expansion for the stress function are allowed to vary. The problem of a centrally located crack in a thin elastic plate is analyzed, and the values of the stress intensity factor K sub 1 are given for the various special elements considered. In each case, the value K sub 1 is seen to converge monotonically as the number of terms in the series expansion is increased. Author

N77-23537*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT OF A CURVED PIPE CAPABILITY FOR THE NASTRAN FINITE ELEMENT PROGRAM
James W. Jeter, Jr. Mar. 1977 48 p refs
(NASA-TM-X-72016) Avail: NTIS HC A03/MF A01 CSCL 13M

A curved pipe element capability for the NASTRAN structural analysis program is developed using the NASTRAN dummy element feature. A description is given of the theory involved in the subroutines which describe stiffness, mass, thermal and enforced deformation loads, and force and stress recovery for the curved pipe element. Incorporation of these subroutines into NASTRAN is discussed. Test problems are proposed. Instructions on use of the new element capability are provided. Author

N77-23538# Aeronautical Research Labs., Melbourne (Australia).
STIFFENING OF A BOAT PROPELLER SHAFT BEARING SUPPORT BRACKET BY A CFRP OVERLAY
R. Ellis Apr. 1976 21 p refs
(ARL/Struc-Note-425) Avail: NTIS HC A02/MF A01

Vibration problems have occurred in the propeller shafts of ten meter boats. Each shaft runs in a bearing which is attached to the hull by an aluminum bronze bracket and there was a requirement to increase the stiffness of this bracket. An efficient, cheap, and quick method was sought for a first unit and a description is given of how this was achieved by the construction of a carbon fiber reinforced plastic (CFRP) overlay for the existing bracket. Author

N77-23539*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Aerospace and Ocean Engineering Dept.
A METHOD FOR EXPERIMENTAL MODAL SEPARATION Final Technical Report, Feb. 1976 - May 1977
William L. Hallauer, Jr. May 1977 24 p
(Grant NsG-1276)
(NASA-CR-153047) Avail: NTIS HC A02/MF A01 CSCL 20K

A method is described for the numerical simulation of multiple-shaker modal survey testing using simulated experimental data to optimize the shaker force-amplitude distribution for the purpose of isolating individual modes of vibration. Inertia, damping, stiffness, and model data are stored on magnetic disks, available by direct access to the interactive FORTRAN programs which perform all computations required by this relative force amplitude distribution method. Author

N77-23540# California Univ., Livermore. Lawrence Livermore Lab.
PRELIMINARY USER'S MANUALS FOR DYNA3D AND DYNAP (NONLINEAR DYNAMIC ANALYSIS OF SOLIDS IN THREE DIMENSIONS)
J. O. Hallquist Aug. 1976 75 p refs
(Contract W-7405-eng-48)
(UCID-17268) Avail: NTIS HC A04/MF A01

DYNA3D is an explicit three-dimensional finite element code for analyzing the large deformation dynamic response of solids. Elastic-plastic and hyperelastic material behavior can be modeled. A contact-impact algorithm permits gaps and sliding along material interfaces. By a specialization of this algorithm such interfaces can be rigidly tied to admit variable zoning without the need of transition regions. ERA

N77-23541# Argonne National Lab., Ill.
ACOUSTICALLY INDUCED VIBRATION OF CIRCULAR CYLINDRICAL RODS
Hsuan-Chi Lin and S. S. Chen Aug. 1976 22 p refs
(Contract W-31-109-eng-38)
(ANL-CT-76-44) Avail: NTIS HC A02/MF A01

The steady-state response of a circular cylindrical rod subjected to a plane wave are analyzed; rod displacement natural frequency including fluid inertia effect, and radiation damping, are obtained in closed form. The added mass coefficient depends only on the nondimensional wave number alpha and the radiation damping zeta/sub r/depends on alpha and mass ratio beta. The rod displacement is proportional to wave amplitude and rod radius, and depends on alpha and beta. ERA

N77-23542# Argonne National Lab., Ill.
DYNAMIC INELASTIC RESPONSE OF THICK SHELLS USING ENDOCHRONIC THEORY AND THE METHOD OF NEARCHARACTERISTICS
Hsuan-Chi Lin Aug. 1976 15 p refs
(Contract W-31-109-eng-38)
(ANL-CT-76-43) Avail: NTIS HC A02/MF A01

The endochronic theory of plasticity originated by Valanis was applied to study the axially symmetric motion of circular cylindrical thick shells subjected to an arbitrary pressure transient applied at its inner surface. The constitutive equations for the thick shells were obtained. The governing equations are then solved by means of the near-characteristics method. ERA

N77-23543# California Univ., Livermore. Lawrence Livermore Lab.
SOIL STRUCTURE INTERACTION CALCULATIONS: A COMPARISON OF METHODS
L. Wight and M. Zaslawsky 22 Jul. 1976 60 p refs
(Contract W-7405-eng-48)
(UCRL-52106) Avail: NTIS HC A04/MF A01

Two approaches for calculating soil structure interaction (SSI) are compared: finite element and lumped mass. Results indicate that the calculations with the lumped mass method are generally conservative compared to those obtained by the finite element method. They also suggest that a closer agreement between the two sets of calculations is possible, depending on the use of frequency-dependent soil springs and dashpots in the lumped mass calculations. There is a total lack of suitable guidelines for implementing the lumped mass method of calculating SSI, which

leads to the conclusion that the finite element method is generally superior for calculative purposes. ERA

N77-23544# Naval Construction Research Establishment, Dunfermline (Scotland).
PLANE GRILLAGE SUITE OF PROGRAMS
W. J. Simons Aug. 1976 56 p refs Supersedes NCRE/R481
(NCRE/R637; BR55362; NCRE/R481) Avail: NTIS HC A04/MF A01

A suite of programs for calculating deflections and stresses, buckling loads, and natural frequencies of a plane grillage is described. The suite has additional facilities for generating and checking data and, for larger problems, an out of core solution for stresses. Author (ESA)

N77-23545# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Werkstoff-Forschung.
COMPARISON OF DIFFERENT EQUATIONS FOR CALCULATION OF J-INTEGRAL FROM ONE LOAD-DISPLACEMENT CURVE
Hans Peter Keller and Dietrich Munz 5 Nov. 1976 33 p refs Sponsored by Deut. Forschungsgemeinschaft
(DLR-FB-76-56) Avail: NTIS HC A03/MF A01 DFVLR, Cologne DM 14.30

Different approximation methods were compared for linear elastic and ideal linear elastic/plastic behavior and for load-displacement curves, which can be described by linear elasticity with plastic zone correction. For all load-displacement curves the equation of Rice et al. yields better results if the deformation energy of a specimen without a crack is not subtracted from the deformation energy U. The equations of Kanazawa et al. and of Merkle and Corten should be used for small crack lengths. Author (ESA)

N77-23546# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
NON-LINEAR ELASTIC-PLASTIC-CREEP ANALYSIS OF GENERAL SHELLS. UPDATED VERSION OF THE LOCKHEED STAGS-A COMPUTER CODE, PART 3
Lars Aake Samuelson and Sven Ivansson 1976 44 p refs Sponsored in part by Swed. Board for Tech. Develop.
(FFA-HU-1622-Pt-3) Avail: NTIS HC A03/MF A01

The theory and computer code updates necessary to treat time-dependent material deformations, creep in shell structures by use of the STAGS-A computer program are given. Specifically, Norton's creep law was used in conjunction with von Mises' flow rule. The updates necessary to run creep analyses by use of the standard version of STAGS-A are also given. A number of sample cases, including cylinder under axial compression and cylinder under external pression, are described which demonstrate the capabilities of the code; some comparisons are given with other theoretical and experimental data. Author (ESA)

N77-23547# Explosives Research and Development Establishment, Waltham Abbey (England).
A FAILURE CRITERION FOR THE FRACTURE OF STRUCTURAL ADHESIVE JOINTS
R. A. Gledhill and A. J. Kinloch Apr. 1976 25 p refs
(ERDE-TR-261; BR55031) Avail: NTIS HC A02/MF A01

The long-term strength of stressed, structural adhesive joints, consisting of aluminum alloy substrates bonded with an epoxide adhesive, was investigated. The adhesive fracture energy, Glc, is shown to be linearly dependent upon the logarithmic time-to-failure; the failure time decreases as the value of Glc is increased. The fracture of these joints over eight decades of time is uniquely described by the hypothesis that there is a critical plastic-zone size developed at the crack tip at failure. Author (ESA)

N77-23548# California Univ., Berkeley. Earthquake Engineering Research Center.
STRUCTURAL STEEL BRACING SYSTEMS: BEHAVIOR UNDER CYCLIC LOADING
E. P. Popov, K. Takanashi, and C. W. Roeder Jun. 1976 82 p refs Sponsored in part by Am. Iron and Steel Inst.
(Grant NSF ENV-76-04263)
(PB-260715/8; EERC-76-17) Avail: NTIS HC A05/MF A01 CSCL 13M

The performance of steel braced frame structures under cyclic excitations are surveyed. Particular emphasis is placed on inelastic behavior under extreme credible excitations which may occur during a severe earthquake. The experimental and analytical studies of the behavior of an individual brace are described. The effect of the individual braces on the behavior of the entire structural system is then brought out. The behavior of a concentrically braced frame is discussed with respect to dynamic response to given excitations as well as its quasi-static hysteretic behavior under cyclic load. GRA

N77-23549# Missouri Univ., Rolla. Dept. of Civil Engineering.
DYNAMIC INSTABILITY AND ULTIMATE CAPACITY OF INELASTIC SYSTEMS PARAMETRICALLY EXCITED BY EARTHQUAKES, PART 2
Franklin Y. Cheng and Kenneth B. Oster Aug. 1976 339 p refs
(Grant NSF GI-34966)
(PB-261097/0; Civil-Engineering-Study-76-1) Avail: NTIS HC A15/MF A01 CSCL 13M

The behavior of multi-story framed structures subjected to the interaction of horizontal and vertical components of an earthquake is studied. Frameworks having three to ten stories and one to three bays are studied on the basis of two lumped mass models with elastic, elasto-plastic and bilinear material behavior. The studies include the characteristics of input energy, kinetic energy, elastic strain energy, dissipated strain, and damping energy; the reduction of plastic moment capacity of columns; ductility and excursion rations; and the P-delta effect. Numerical results show that the inclusion of the vertical ground motion can significantly influence the response parameters of lateral displacements and ductility requirements and consequently causes structural collapse. GRA

N77-23550# Lockheed-California Co., Burbank.
EFFECTS OF COMBINED ACOUSTIC AND FLIGHT LOADS OF CRACK GROWTH Final Report, Jun. 1975 - Jul. 1976
J. Soovere and S. T. Chiu Wright-Patterson AFB, Ohio AFFDL Jul. 1976 161 p refs
(Contract F33615-75-C-3087)
(AD-A033573; LR-27697; AFFDL-TR-76-68) Avail: NTIS HC A08/MF A01 CSCL 11/6

A method for simulating the random acoustic excitation on a stiffened panel with an electromagnetic shaker was developed. The shaker simulation of the acoustic loading was verified both experimentally and theoretically over a wide range of axially applied tension and compression loads. Two flight-by-flight load spectra, corresponding to the upper and lower wing surface loads for typical Advanced Medium Transport Aircraft were developed and used in the test program. Real time takeoff and accelerated flight durations were used. The shaker simulated acoustic and axial flight-by-flight loads were applied both separately and simultaneously to a total of twelve stiffened panels. The measured crack growth data was compared with current analysis methods. Crack propagation paths, and magnified photographs and fractographs of the crack surfaces are presented. No significant effects on the crack growth rate are obtained by the simultaneous application of the acoustic and flight loads. The observed crack branching is, however, attributed to the acoustic loading. GRA

N77-23551# Dayton Univ. Research Inst., Ohio.
STABILITY OF FLAT, SIMPLY SUPPORTED, RECTANGULAR SANDWICH PANELS SUBJECTED TO COMBINED INPLANE LOADINGS. VOLUME 1: THEORETICAL DEVELOPMENT Final Report, Nov. 1974 - Jun. 1975
R. A. Brockman Wright-Patterson AFB, Ohio AFFDL Sep. 1976 57 p refs
(Contract F33615-75-C-3009; AF Proj. 1368)
(AD-A033594; UDRI-TR-75-51-Vol-1; AFFDL-TR-76-14-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 13/13

The general stability of flat, rectangular sandwich panels loaded by combined biaxial compression, biaxial edgewise bending and edgewise shear is investigated. The analysis is applicable to sandwich structures having isotropic face sheets and orthotropic

cores. The analysis procedure is based upon a linear potential energy formulation and the Ritz method of discretization. For the case of simply supported boundaries, it is shown that the equations can be uncoupled in such a way that a numerical solution is obtained in an economical fashion. A number of verification results are presented. Comparisons are made between the numerical solutions and the predictions of certain interaction formulas which are commonly employed in sandwich panel design. Author (GRA)

N77-23552# City Univ. of New York. Dept. of Mathematics.
BUCKLING OF A COMPLETE SPHERICAL SHELL UNDER UNIFORM EXTERNAL PRESSURE Interim Report
Harry E. Rauch, Neal H. Jacobs, and Jonathan L. Marz 1976 45 p refs
(Grant AF-AFOSR-2063-71; AF Proj. 2304)
(AD-A033314; AFOSR-76-1219TR) Avail: NTIS HC A03/MF A01 CSCL 13/13

Non-linear axisymmetric buckling of a complete spherical elastic shell under uniform external pressure is treated numerically. Particular attention is given to the lower critical load, which is the theoretical least failure load. Among the new results are the evaluation of this load for thinner shells than those treated in the existing literature; in particular, the values 6.73% and 4.9% of the classical linear buckling loads are obtained for the radius-to-thickness ratios 100 and 200, respectively. The shapes of the buckled shells are computed for the first time in an unexpected hint that there is an asymptotic (ratios-to-thickness ration-independent) buckled shape. Numerical solution is by means of spectral (Galerkin) expansions of up to 60 modes in associated Legendre functions of order one applied to the quadratically non-linear version of E. Reissner's equations. Author (GRA)

N77-23553# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
ENGINEERING ANALYSIS USING ARBITRARY GRID FINITE DIFFERENCE TECHNIQUES Final Report
Paul S. Jensen and Frank A. Brogan 3 Aug. 1976 45 p refs
(Contract F44620-71-C-0109)
(AD-A032864; LMSC-D507700; AFOSR-76-1302TR) Avail: NTIS HC A03/MF A01 CSCL 13/7

In this report, several experiments on the analysis of shell structures using the STAGS-FIDAG computer program combination are described. STAGS(Structural Analysis of General Shells) is a general engineering analysis computer program particularly useful for nonlinear problems and FIDAG (Finite Differences on Arbitrary Grids) is a general program for finite difference interpolation on arbitrary grids. Author (GRA)

N77-23554# Polytechnic Inst. of New York, Brooklyn. Dept. of Aerospace Engineering and Applied Mechanics.
MODAL METHOD FOR FREE VIBRATION OF FINITE OVAL CYLINDRICAL SHELL WITH FREE ENDS Interim Report
Y. N. Chen and Joseph Kempner Sep. 1976 30 p refs
(Contract F44620-74-C-0047; AF Proj. 9782)
(AD-A032907; Poly-M/AE-76-1; AFOSR-76-1203TR) Avail: NTIS HC A03/MF A01 CSCL 20/11

The modal method developed by the authors applicable to the dynamic analysis of supported noncircular cylindrical shells is extended in the present work to deal with (but not restricted to) the free vibration problem of unsupported noncircular cylinders. The required modification includes the enforcement of the edge conditions at the free ends of a finite cylindrical shell which are unsatisfied by the modal functions owing to the presence of the variable curvature terms. Such conditions are posed as additional constraints by way of the well-known formalism of Lagrange multipliers. In addition, it was found that the inclusion of the lowest modes, commonly approximated by the Rayleigh-Love modes, is essential to the completeness of the eigen-function representation. The validity of the proposed procedure of analysis is illustrated by its application to the solution of the free vibration problem of oval cylindrical shells with free ends. Author (GRA)

N77-23555# Battelle Columbus Labs., Ohio.
THREE-DIMENSIONAL FRACTURE ANALYSIS Final Report, 1 Apr. - 30 Nov. 1976
L. E. Hulbert 3 Nov. 1976 123 p refs Presented at Proc. of a Workshop, Columbus, Ohio, 26-28 Apr. 1976
(Grant AF-AFOSR-2944-76; AF Proj. 6813)
(AD-A033821; AFOSR-76-1306TR) Avail: NTIS HC A06/MF A01 CSCL 20/12

A three day workshop was held at Battelle's Columbus Laboratories on April 26-28, with the purpose of bringing together the nation's leading investigators of three-dimensional fracture to discuss together the present status of three-dimensional fracture analysis. This report presents a summary of the Workshop. The four paper sessions are presented in the form of extended abstracts written by each author with summaries of discussions after each abstract. The remarks of the government representatives are summarized together with discussions of each presentation. A summary is also given of the session in which standards for benchmark problems were discussed and three benchmark problems were chosen. These problems are described in detail. GRA

N77-23556# Naval Surface Weapons Center, White Oak, Md.
A GENERALIZED FINITE DIFFERENCE ELEMENT FOR THE THERMOELASTIC STRUCTURAL RESPONSE OF ANISOTROPIC THIN SHELLS
Robert J. Edwards Jun. 1976 319 p refs
(SF32322507)
(AD-A034788; NSWC/WOL/TR-76-66) Avail: NTIS HC A14/MF A01 CSCL 13/13

Two well established matrix methods for thin shell structural analysis, the finite element method and the finite difference energy method, have been integrated into one unified analytical approach and have been effectively applied to the thermoelastic analysis of anisotropic thin shells. The finite element method is a widely used tool for structural analysis of thin shells due to its ability to model the complex geometries that occur in engineering practice. In recent years, it has been demonstrated that the finite difference energy method offers significant advantages over contemporary finite element formulations especially for problems involving geometrical nonlinearities. However, the method suffers from the modeling restrictions imposed by rectangular gridworks which must follow the shell coordinate lines. The results of this research demonstrate that this classic restriction can be removed and that a generalized finite difference energy method can be developed for arbitrary quadrilateral meshes. Furthermore, the formulation is amenable to installation in contemporary, general purpose, finite element computer programs. GRA

N77-23557# Illinois State Dept. of Transportation, Springfield. Bureau of Materials and Physical Research.
AN INVESTIGATION OF THE SMOOTHNESS CHARACTERISTICS OF HIGHWAY PAVEMENT SURFACES Final Summary Report
John E. LaCroix May 1976 22 p refs
(PB-262986/3; Physical Research-67; FHWA-IL-PR-67) Avail: NTIS HC A02/MF A01 CSCL 13B

Riding quality of newly constructed pavement was studied. Modifications made to the sensing devices of the BPR-Type Roughometer to improve its capabilities in measuring short pavement sections and to increase the operating speed, and calibration techniques are described. GRA

N77-23558# Illinois Univ., Urbana-Champaign. Dept. of Civil Engineering.
COMPUTED BEHAVIOR OF REINFORCED CONCRETE COUPLED SHEAR WALLS
T. Takayanagi and W. C. Schnobrich Dec. 1976 202 p refs
(Grant NSF ATA-74-22962)
(PB-263129/9; UILU-ENG-76-2024; SRS-434) Avail: NTIS HC A10/MF A01 CSCL 13M

The nonlinear response history and failure mechanism of coupled shear wall systems under dynamic loads and static loads are investigated through an analytical model. The walls and coupling beams are replaced by flexural elements. The stiffness characteristics of each member are determined by inelastic properties. The suitable hysteresis loops to each constituent member are established to include the specific characteristics of coupled shear wall systems. The computed results are compared with the available test results. GRA

N77-23559# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science Mechanics.

STRESS INTENSITIES FOR NOZZLE CRACKS IN REACTOR VESSELS Progress Report, 1 Jan. - 31 Oct. 1976
C. W. Smith Nov. 1976 27 p refs Prepared for Union Carbide Corp.
(Contracts W-7405-eng-26; UC-7105)
(PB-263571/2; UPI-E-76-25) Avail: NTIS HC A03/MF A01 CSCL 18I

A series of six frozen stress photoelastic tests was conducted to investigate the distribution of stress intensity factor (SIF) along a crack which occurred at the juncture of a pipe (nozzle) with a cylindrical pressure vessel. Typical photoelastic fringe patterns are shown for slices which were taken mutually orthogonal to the flaw border and the flaw surface. A typical plot of normalized apparent SIF versus square root of normalized distance from the crack tip is presented. The variation in SIF along the flaw border is given for all six different geometries cracks and also the variation of SIF with varying a/T is presented. GRA

N77-23560# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
AN EXPERIMENTAL STUDY OF THE PLATE-NOZZLE TENSILE TEST FOR CRACKED REACTOR VESSEL NOZZLES Progress Report, 1 Apr. 1976 - 31 Jan. 1977
C. W. Smith, M. Jolless, and W. H. Peters Nov. 1976 30 p refs Sponsored by Technische Hogeschool, Delft
(PB-263570/4; UPI-E-76-26) Avail: NTIS HC A03/MF A01 CSCL 13I

A series of four frozen stress photoelastic tests was conducted in order to assess the validity of finite element models of tensilely loaded plates containing cracked reactor vessel nozzle geometries. Although the number of tests was so small as to limit the validity of conclusions to conjecture, the authors feel that the stiffness derivative program yields reasonably accurate SIF distribution predictions along the flaw borders studied, but the flaw shapes do not reflect the flattening obtained experimentally near the center of the flaw border. This causes the flaw depths to vary and, for certain ranges of a/T, may result in a shift of the SIF versus flaw position curve. GRA

N77-23561# Transportation Research Board, Washington, D. C.
ASPHALTS, AGGREGATES, MIXES, AND STRESS-ABSORBING MEMBRANES
E. L. Green, W. J. Tolonen, R. J. Peters, Douglas I. Anderson, and Dale E. Peterson 1976 64 p refs
(PB-262874/1; TRB/TRR-595; ISBN-0-309-02564-8) Avail: NTIS HC A04/MF A01 CSCL 13C

The following topics are discussed: predictability techniques for asphalt durability; evaluation of viscosity-graded asphalt cements in Utah; use of power plant aggregate in bituminous construction; repeated load indirect tensile fatigue characteristics of asphalt mixtures; dynamic analysis of asphaltic-aggregate mixtures; field and laboratory evaluation of asphalt treated base and full depth pavements in Ohio; Virginia's experience with open-graded surface mix; asphalt rubber stress absorbing membranes; field performance and state of the art. GRA

N77-23562# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
COMPARING TRIGONOMETRIC AND CONVENTIONAL FINITE DIFFERENCE APPROXIMATIONS FOR PLATE BUCKLING M.S. Thesis
William Harold Deschler Dec. 1976 71 p refs
(AD-A034938; GAE/MC/76D-3) Avail: NTIS HC A04/MF A01 CSCL 20/11

Finite difference methods for plate buckling were investigated for various two-dimensional plates. The plates were clamped and simply supported. The rate of convergence to buckling coefficients, considering virtual work and equilibrium, have been compared. A trigonometric function (based on long plate theory) was incorporated into the finite difference approximations of the virtual work expression. Additional trigonometric parameters were also considered in the virtual work equation. Little difference in accuracy was found between results obtained from conventional (polynomial) virtual work versus the equilibrium approach. Noticeable improvement is obtained by using a trigonometric function (long plate assumption) in the virtual work expression. GRA

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography. For instrumentation see *35 Instrumentation and Photography*.

N77-23563 Oklahoma State Univ., Stillwater.
STANDARD MAPS AND THE CLASSIFICATION OF TOPOLOGICAL SPACES Ph.D. Thesis
Gary Michael Huckabay 1976 45 p
Avail: Univ. Microfilms Order No. 77-5100

The original definition of standard map is modified so as to obtain classification theorems in a more general setting. Algebraic and topological properties of standard maps are also examined. Vobach's original definition of standard map is modified so that classification theorems for locally compact, separable metric spaces and complete, separable metric spaces are obtained. It is shown that X is connected if and only if G(f,X) cannot be written as a direct sum. Sufficient conditions in terms of G(f,X) for X to be contractible or to have the fixed point property with respect to homeomorphisms. A group A(f,X) is defined which contains G(f,X) as a closed, normal subgroup. It is shown that a certain subgroup of H(X) is the continuous homomorphic image of A(f,X). Furthermore, G(f,X) is the kernel of this map.
Dissert. Abstr.

N77-23564 Oklahoma State Univ., Stillwater.
OPTICAL ROUTING OF LARGE SCALE MARINE SEISMIC MAPPING OPERATIONS Ph.D. Thesis
Thomas Chih-Hsiung Chen 1976 150 p
Avail: Univ. Microfilms Order No. 77-5050

Three approaches were investigated: dynamic programming method, branch and bound method, and graph theoretic method. Five algorithms have been developed and seven separate computer programs have been coded in the first phase of the research work. The best algorithm developed to solve the single-ship through single-prospect problem is the algorithm based upon a modification of Little's branch and bound method. The computer program for this algorithm requires only 60 K bytes to solve a 14-line configuration problem. The computation time is also very effective. Dissert. Abstr.

N77-23565 Central Electricity Generating Board, London (England).
CEGB DIGEST, VOLUME 29, NO. 4, ABSTRACTS 598-725
Apr. 1977 21 p
Avail: Issuing Activity

Abstracts of bibliographies dealing with electric power supplies and related materials engineering are presented. I.M.

N77-23566*# Atomic Energy Commission, Dacca (Bangladesh).
INVESTIGATIONS USING DATA FROM LANDSAT-2 Quarterly Report, Jan. - Mar. 1977
Anwar Hossain, Principal Investigator Apr. 1977 3 p refs Sponsored by NASA ERTS
(E77-10152; NASA-CR-152698) Avail: NTIS HC A02/MF A01 CSCL 05B

The author has identified the following significant results. LANDSAT imageries of Mirpur area of Dacca district were used in connection with surveys for black plastic clay. The imageries showed the broad pattern of small valleys cutting into Madhupur clay. Land use maps of Haor areas of Sylhet and Mymensingh districts were prepared. As a test case, two thana areas, namely Nickley and Astogram, were classified in different categories such as crop, settlement, and water. It does not show much agreement with the Agriculture Dept.'s statistics.

N77-23567*# Texas A&M Univ., College Station. Remote Sensing Center.
APPLIED REGIONAL MONITORING OF THE VERNAL ADVANCEMENT AND RETROGRADATION (GREEN WAVE EFFECT) OF NATURAL VEGETATION IN THE GREAT PLAINS CORRIDOR Final Report, Feb. 1975 - Dec. 1976
John W. Rouse, Jr., Principal Investigator, D. W. Deering, R. H. Haas, R. I. Welch, J. C. Harlan, and P. R. Whitney Jan. 1977 235 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20796)
(E77-10153; NASA-CR-152699; RSC-3018-6) Avail: NTIS HC A11/MF A01 CSCL 08F

The author has identified the following significant results. LANDSAT 2 has shown that digital data products can be effectively employed on a regional basis to monitor changes in vegetation conditions. The TV16 was successfully applied to an extended test site and the Great Plains Corridor in tests of the ability to assess green forage biomass on rangelands as an index to vegetation condition. A strategy for using TV16 on a regional basis was developed and tested. These studies have shown that: (1) for rangelands with good vegetative cover, such as most of the Great Plains, and which are not heavily infested with brush or undesirable weed species, the LANDSAT digital data can provide a good estimate (within 250 kg/ha) of the quantity of green forage biomass, and (2) at least five levels of pasture and range feed conditions can be adequately mapped for extended regions.

N77-23568*# Ceylon Inst. of Scientific and Industrial Research, Colombo (Sri Lanka).
INVESTIGATION OF THE AGRICULTURAL RESOURCES IN SRI LANKA Progress Report, Jul. 1976 - Apr. 1977
A. T. M. Silva, S. D. F. C. Nanayakkara, and L. S. K. B. Herath, Principal Investigators Apr. 1977 25 p Sponsored by NASA ERTS
(E77-10164; NASA-CR-152665) Avail: NTIS HC A02/MF A01 CSCL 02C

The author has identified the following significant results. Several in-house capabilities were developed. The facilities to prepare color composites of excellent quality were developed, using bulk B/W 70 mm transparencies or 1:1,000,000 positive transparencies. These color composites were studied through optical devices on light tables. A zoom transfer scope was also added, enabling direct transfer of LANDSAT composite data on to base maps.

N77-23569*# Geological Survey, Reston, Va.
DETECTION OF SHORT-TERM CHANGES IN VEGETATION COVER BY USE OF LANDSAT IMAGERY Final Report, 1 Jul. 1972 - 30 Jun. 1974
Raymond M. Turner, Principal Investigator and Frederick M. Wiseman Jun. 1975 52 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10165; NASA-CR-152666) Avail: NTIS HC A04/MF A01 CSCL 02C

The author has identified the following significant results. By using a constant band 6 to band 5 radiance ratio of 1.25, the changing pattern of areas of relatively dense vegetation cover was detected for the semiarid region in the vicinity of Tucson, Arizona. Electronically produced binary thematic masks were used to map areas with dense vegetation. The foliar cover threshold represented by the ratio was not accurately determined but field measurements show that the threshold lies in the range of 10 to 25 percent foliage cover. Montana evergreen forests with constant dense cover were correctly shown to exceed the threshold on all dates. The summer active grassland exceeded the threshold in the summer unless rainfall was insufficient. Desert areas exceeded the threshold during the spring of 1973 following heavy rains; the same areas during the rainless spring of 1974 did not exceed threshold. Irrigated fields, parks, golf courses, and riparian communities were among the habitats most frequently surpassing the threshold.

N77-23570*# Instituto Geografico y Catastral, Madrid (Spain).
THEMATIC MAPPING, LAND USE, GEOLOGICAL STRUCTURE AND WATER RESOURCES IN CENTRAL SPAIN Final Report
Nunez DelasCuevas, Principal Investigator 6 Nov. 1976 286 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E77-10167; NASA-CR-152668) Avail: NTIS HC A13/MF A01 CSCL 08B

The author has identified the following significant results. The images can be positioned in an absolute reference system (geographical coordinates or polar stereographic coordinates) by means of their marginal indicators. By digital analysis of LANDSAT data and geometric positioning of pixels in UTM projection, accuracy was achieved for corrected MSS information which could be used for updating maps at scale 1:200,000 or smaller. Results show that adjustment of the UTM grid was better obtained by a first order, or even second order, algorithm of geometric correction. Digital analysis of LANDSAT data from the Madrid area showed that this line of study was promising for automatic classification of data applied to thematic cartography and soils identification.

N77-23571*# South Dakota State Univ., Brookings. Remote Sensing Inst.
INVESTIGATION OF REMOTE SENSING TECHNIQUES AS INPUTS TO OPERATIONAL RESOURCE MANAGEMENT MODELS Interim Report, 11 Jun. - 10 Dec. 1976
F. A. Schmer, Principal Investigator, R. E. Isakson, and J. C. Eidenshink Feb. 1977 36 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20982)
(E77-10168; NASA-CR-152669; SDSU-RSI-77-01) Avail: NTIS HC A03/MF A01 CSCL 05A

The author has identified the following significant results. Successful operational applications of LANDSAT data were found for level 1 land use mapping, drainage network delineation, and aspen mapping. Visual LANDSAT interpretation using 1:125,000 color composite imagery was the least expensive method of obtaining timely level 1 land use data. With an average agricultural/rangeland interpretation accuracy in excess of 80%, such a data source was considered the most cost effective of those sources available to state agencies. Costs do not compare favorably with those incurred using the present method of extracting land use data from historical tabular summaries. The cost increase in advancing from the present procedure to a satellite-based data source was justified in terms of expanded data content.

N77-23572*# Environmental Research Inst. of Michigan, Ann Arbor.
WHEAT PRODUCTIVITY ESTIMATES USING LANDSAT DATA Progress Report, 16 Nov. 1976 - 15 Feb. 1977
Richard F. Nalepka, John Colwell, Principal Investigators, and Daniel P. Rice 15 Feb. 1977 41 p refs ERTS
(Contract NAS5-22389)
(E77-10169; NASA-CR-152670; ERIM-114800-31-L) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. An initial demonstration was made of the capability to make direct production forecasts for winter wheat using early season LANDSAT data. The approach offers the potential to make production forecasts quickly and simply, possibly avoiding some of the complexities of alternate procedures.

N77-23573*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RESULTS FROM THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION REMOTE SENSING EXPERIMENTS IN THE NEW YORK BIGHT, 7-17 APRIL 1975
John B. Hall, Jr., comp. and Albin O. Pearson, comp. Apr. 1977 190 p refs
(NASA-TM-X-74032) Avail: NTIS HC A09/MF A01 CSCL 05B

A cooperative operation was conducted in the New York

Bight to evaluate the role of remote sensing technology to monitor ocean dumping. Six NASA remote sensing experiments were flown on the C-54, U-2, and C-130 NASA aircraft, while NOAA obtained concurrent sea truth information using helicopters and surface platforms. The experiments included: (1) a Radiometer/ Scatterometer (RADSCAT), (2) an Ocean Color Scanner (OCS), (3) a Multichannel Ocean Color Sensor (MOCS), (4) four Hasselblad cameras, (5) an Ebert spectrometer; and (6) a Reconafax IV infrared scanner and a Precision Radiation Thermometer (PRT-5). The results of these experiments relative to the use of remote sensors to detect, quantify, and determine the dispersion of pollutants dumped into the New York Bight are presented.
Author

N77-23574*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
DISSEMINATING TECHNOLOGICAL INFORMATION ON REMOTE SENSING TO POTENTIAL USERS
J. D. Russell and John C. Lindenlaub 1977 12 p refs
(Contracts NAS9-14016; NAS9-149170)
(NASA-CR-151340; IN-042777) Avail: NTIS HC A02/MF A01 CSCL 05B

The Laboratory for Applications of Remote Sensing developed materials and programs which range from short tutorial brochures to post-doctoral research programs which may span several years. To organize both the content and the instructional techniques, a matrix of instructional materials was conceptualized. Each row in the matrix represents a subject area in remote sensing and each column in the matrix represents a different type media or instructional strategy.
Author

N77-23575*# Purdue Univ., Lafayette, Ind. Laboratory for Applications of Remote Sensing.
THE FOCUS SERIES: A COLLECTION OF SINGLE-CONCEPT REMOTE SENSING EDUCATIONAL MATERIALS
S. M. Davis 1977 83 p
(Contract NAS9-14016; NAS9-14970; Grant NGL-15-005-112)
(NASA-CR-151341; LARS-IN-052977) Avail: NTIS HC A05/MF A01 CSCL 05B

The FOCUS series is a collection of two-page foldout documents each consisting of a diagram or photograph and an extended option of three to four hundred words. The series was developed to present basic remote sensing concepts in a simple, concise way. Issues currently available are collected in this information note.
Author

N77-23576*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN OPERATIONAL EARTH RESOURCES SATELLITE SYSTEM: THE LANDSAT FOLLOW-ON PROGRAM
W. G. Stroud Mar. 1977 23 p refs Presented at 14th Space Congr., Lompoc, Calif., 27-29 Apr. 1977 Submitted for publication
(NASA-TM-X-71306; X-900-77-68) Avail: NTIS HC A02/MF A01 CSCL 22A

The LANDSATS 1 and 2 have demonstrated the role of remote sensing from satellite in research, development, and operational activities essential to the better management of our resources. Hundreds of agricultural, geological, hydrological, urban land use, and other investigations have raised the question of the development of an operational system providing continuous, timely data. The LANDSAT Follow-on Study addressed the economics, technological performance, and design of a system in transition from R and D to operations. Economic benefits were identified; and a complete system from sensors to the ultilization in forecasting crop production, oil and mineral exploration, and water resources management was designed.
Author

N77-23577*# National Aeronautics and Space Administration, Washington, D. C.
WHAT'S THE USE OF LAND? (A SECONDARY SCHOOL SOCIAL STUDIES PROJECT)
Oct. 1976 60 p refs
(NASA-EP-103) Avail: NTIS HC A04/MF A01 CSCL 05B

The concept of a student land use survey was discussed with the curriculum development team of the Jefferson County Public Schools in Colorado. In these discussions it soon became apparent that the curriculum potentials included much more than a classroom activity involving mapping the features on the ground in the area of study. A new flood control dam to be located in the area of Denver, Colorado, became the central topic in a program involving a wide variety of curriculum fields, such as mapmaking, local community history, physical geography, mathematics, and environmental studies. Consequently, a prototype of a multidisciplinary unit concept was developed for later incorporation by the Jefferson County curriculum team.
Author

N77-23578*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: US STANDARD CATALOG, 1 FEBRUARY 1977 - 28 FEBRUARY 1977
28 Feb. 1977 78 p
(NASA-TM-X-74692; GSFC/LU-C/002; NTISUB/C/138-002)
Avail: NTIS HC A05/MF A01 CSCL 05B

The U.S. Standard Catalog lists U.S. imagery acquired by LANDSAT 1 and LANDSAT 2 which has been processed and input to the data files during the referenced month. Data, such as data acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given.
Author

N77-23579*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: NON-US STANDARD CATALOG, A MARCH 1977 - 31 MARCH 1977
31 Mar. 1977 88 p
(NASA-TM-X-74693; GSFC/LN-C/003; NTISUB/C/139-003)
Avail: NTIS HC A05/MF A01 CSCL 05B

The Non-U.S. Catalog lists Non-I.S. imagery acquired by LANDSAT 1 and 2 which has been processed and input of the data files during the referenced month. Data, such as date acquired, cloud cover and image quality are given for each scene. The microfilm roll andframe on which the scene may be found is also given.
Author

N77-23580# Geological Survey, Reston, Va.
A LAND USE AND LAND COVER CLASSIFICATION SYSTEM FOR USE WITH REMOTE SENSOR DATA
James R. Anderson, Ernest E. Hardy, John T. Roach, and Richard E. Witmer 1976 31 p refs
(USGS-Circ-671; USGS Professional Paper-964) Avail: NTIS HC A03/MF A01 CSCL 08B

The framework of a national land use and land cover classification system is presented for use with remote sensor data. The classification system was developed to meet the needs of Federal and state agencies for an up-to-date overview of land use and land cover throughout the country on a basis that is uniform in categorization at the more generalized first and second levels and that will be receptive to data from satellite and aircraft remote sensors. The proposed system uses the features of existing widely used classification systems that are amenable to data derived from remote sensing sources. Author

N77-23581# Nevada Univ., Reno. Center for Water Resources Research.
WATER TABLE AND RELATED MAPS FOR NEVADA TEST SITE AND CENTRAL NEVADA TEST AREA
Paul R. Fenske and Chalon L. Carnahan Apr. 1976 132 p refs
(Contract E(29-2)-1253)
(NVO-1253-9) Avail: NTIS HC A07/MF A01

Water table maps, water table gradient maps, and depth-to-water maps were constructed for the Nevada Test Site and the Central Nevada Test Area by empirical simulation using a digital computer. Although the digital computer program was developed specifically for the areas mapped, it is directly applicable to any hydrologic province where ground water recharge areas occur between the discharge areas such a humid regions and the arid Great Basin of the western United States. Maps constructed during May 1975, a listing of the water level control points, and a brief description of the empirical mapping technique are presented.
ERA

N77-23582# Netherlands Interdepartmental Working Group on the Application of Remote Sensing, Delft.
REMOTE SENSING OF OIL POLLUTION AT THE SEA SURFACE 1. REVIEW OF REMOTE SENSING METHODS EMPHASIZING RADAR
J. vanKuilenburg Jul. 1975 29 p refs
(NIWARS-Publ-21) Avail: NTIS HC A03/MF A01

The problem of monitoring oil pollution is described and the remote sensing methods applicable for that purpose are reviewed. A detailed discussion is presented on radar observations of oil slicks and of the surrounding sea surface. A selected bibliography is given. Author (ESA)

N77-23583# Netherlands Interdepartmental Working Group on the Application of Remote Sensing, Delft.
REMOTE SENSING OF OIL POLLUTION AT THE SEA SURFACE 2. DAMPING OF WATER WAVES BY AN OIL LAYER AS A POSSIBLE INDICATOR FOR SLAR OBSERVATIONS Ph.D. Thesis - Univ. of Technol.
A. C. Pronk Jul. 1975 12 p refs
(NIWARS-Publ-22) Avail: NTIS HC A02/MF A01

The damping action of oil pollution on sea waves is discussed in view of observation from the air. It is found that oil layers of all thicknesses damp a part of the wave spectrum. Only in the case of thicker layers is the damping related to the nature of the oil. The distance over which the sea waves damp out after an oil slick has entered seems a useful indicator for the oil properties. Author (ESA)

N77-23584# Netherlands Interdepartmental Working Group on the Application of Remote Sensing, Delft.
A MODEL STUDY ON THE RELATIONS BETWEEN CROP CHARACTERISTICS AND CANOPY SPECTRAL REFLECTANCE. PART 1: DEDUCTION OF CROP PARAMETERS FROM CANOPY SPECTROREFLECTANCE DATA. PART 2: DETECTABILITY OF VARIATIONS IN CROP PARAMETERS BY MULTISPECTRAL SCANNING
W. Verhoef and N. J. J. Bunnik Dec. 1975 101 p refs
(NIWARS-Publ-33) Avail: NTIS HC A06/MF A01

The canopy reflectance model developed by G. H. Suits was used to establish relationships between canopy reflectance and agricultural crop parameters. These relationaships were calculated for perpendicular view and a fixed sun angle. Attempts to find methods of deduction of crop parameters from canopy spectroreflectance data, based on the Suits model, have not yet led to satisfactory results. This is mainly due to the variability of leaf and soil optical characteristics. The detectability of variations in certain crop parameters was studied by identifying the scanner's noise equivalent reflectance difference with a canopy reflectance difference caused by variation of a crop parameter. The results obtained should be used in an indicative way. Author (ESA)

N77-23585# Netherlands Interdepartmental Working Group on the Application of Remote Sensing, Delft.
THE SPECTRAL DIRECTIONAL REFLECTANCE OF ROW CROPS. PART 1: CONSEQUENCES OF NON-LAMBERTIAN BEHAVIOUR FOR AUTOMATIC CLASSIFICATION. PART 2: MEASUREMENTS ON WHEAT AND SIMULATIONS BY MEANS OF A REFLECTANCE MODEL FOR ROW CROPS
W. Verhoef and N. J. J. Bunnik Jun. 1976 144 p refs
(NIWARS-Publ-35) Avail: NTIS HC A07/MF A01

The one-layer Suits model for canopy reflectance was applied to simulate a multispectral scanning flight over an agricultural area. Non-Lambertian behavior and misclassification were studied on the basis of unprocessed and preprocessed data from the reflectance simulations. A new experimental model for the calculation of the directional reflectance of row crops, based on the one-layer Suits model, is presented. This model was applied to simulate measurements of the spectral directional reflectance on mechanically sowed wheat at several growth stages in the summer of 1974. In general, input and output data of both model and field data agree well. Specular reflection at leaves, not incorporated in the present model, appears to be a significant factor for crop reflectance. Author (ESA)

N77-23586# Army Engineer Topographic Labs., Fort Belvoir, Va. Computer Sciences Lab.
STEREO ANALYSIS OF A SPECIFIC DIGITAL MODEL SAMPLED FROM AERIAL IMAGERY
Michael A. Crombie Sep. 1976 64 p refs
(AD-A033567; ETL-0072) Avail: NTIS HC A04/MF A01 CSCL 08/2

Approximately 160,000 points were matched over a digitized stereo model using correlation algorithms coded in FORTRAN for the CDC 6400. Each of the digitized stereo pair was represented by over 4 million pixels, which were measured on a microdensitometer and stored on disc in the Image Processing Center at ETL. The matched point coordinates and the associated local coordinates were also stored on disc. The derived digital model will be used in the Interactive Image Processing Center to evaluate a variety of problems in digital image processing of stereo photography. GRA

N77-23587# Environmental Research Inst. of Michigan, Ann Arbor.
BASIC INVESTIGATIONS FOR REMOTE SENSING OF COASTAL AREAS Quarterly Report, 16 Jul. - 15 Oct. 1976
R. A. Shuchman, D. R. Lyzenga, and F. J. Thomson 1976 6 p refs
(Contract N00014-74-C-0273)
(AD-A032447; ERIM-108900-8-L) Avail: NTIS HC A01/MF A01 CSCL 17/8

During the quarterly period 16 July - 15 October 1976, three principle activities took place. The second year interim report was printed and distributed. Work was completed on obtaining critical optical properties of beach minerals to be used as inputs into the Beach and Environment Models. In the water modeling area, the water-atmosphere model was tested and used in a study for the Naval Coastal Systems Lab., and analysis of model results in the context of MRA development has begun. In connection with this task, a letter was sent to the Editor of Applied Optics on the reflectance of a flat ocean in the limit of zero water depth. GRA

N77-23588*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: NON-US STANDARD CATALOG
28 Feb. 1977 101 p
(NASA-TM-X-74691; GSFC/LN-C/002; NTISUB/C/139-002)
Avail: NTIS HC A06/MF A01 CSCL 05B

Information regarding the availability of LANDSAT imagery processed and input to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska and Hawaii. The Non-U.S. Standard Catalog identifies all the remaining coverage. Sections 1 and 2 describe the contents and format for the catalogs and the associated microfilm. Section 3 provides a cross-reference defining the beginning and ending dates for LANDSAT cycles. Sections 4 and 5 cover LANDSAT-1 and LANDSAT-2 coverage, respectively. Author

N77-23589*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT: US STANDARD CATALOG
31 Mar. 1977 93 p
(NASA-TM-X-74690; GSFC/LU-C/003; NTISUB/C/138-003)
Avail: NTIS HC A05/MF A01 CSCL 05B

Information regarding the availability of LANDSAT imagery processed and input to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska and Hawaii. The Non-U.S. Standard Catalog identifies all the remaining coverage. Sections 1 and 2 describe the contents and format for the catalogs and the associated microfilm. Section 3 provides a cross-reference defining the beginning and ending dates for LANDSAT cycles. Sections 4 and 5 cover LANDSAT-1 and LANDSAT-2 coverage, respectively. Author

N77-23590# Particle Measuring Systems, Boulder, Colo.
THE RESPONSE OF OPTICAL ARRAY SPECTROMETERS TO ICE AND SNOW: A STUDY OF 2-D PROBE AREA-TO-MASS RELATIONSHIPS Final Report, 22 Mar. - 30 Jun. 1976
Robert G. Knollenberg 8 Nov. 1976 36 p refs

(Contract F19628-75-C-0141; AF Proj. 627A)
(AD-A034741; AFGL-TR-76-0273) Avail: NTIS HC A03/MF A01 CSCL 20/6

Theoretical and field data analysis were performed to determine area-to-mass relationships for the response of 2-D Optical Array Spectrometers to snow crystals. A single theoretical relationship was found adequate to correct the measured area to true area for all but stellar dendrites and needles. Area-to-mass relationships established from the analysis of field data were found to be well behaved. The application of software without complete habit definition is discussed and shown to be potentially feasible. GRA

N77-23591# Human Engineering Labs., Aberdeen Proving Ground, Md.

HUMAN ENGINEERING LABORATORY CAMOUFLAGE APPLICATIONS TEST (HELCAT) OBSERVER PERFORMANCE Final Report

John A. Barnes and N. William Doss Nov. 1976 51 p refs
(AD-A034048; HEL-TM-32-76) Avail: NTIS HC A04/MF A01 CSCL 01/3

This study recorded the target-detection ranges achieved by 10 combat-qualified U.S. Army Aviators flown on nap-of-the-earth route reconnaissance against camouflaged tanks, and their target detection times when performing the pop-up maneuver against the camouflaged tanks. On 10 of the 20 day flights the aviators' eye movements and fixation points were recorded, and the aviators wore the AN/PVS-5 night vision goggles on 10 of the 20 night flights. GRA

N77-23592# Arizona Univ., Tucson. Office of Arid Lands Studies.

GEOTHERMAL TECHNOECOSYSTEMS AND WATER CYCLES IN ARID LANDS

Christopher Duffield 1976 217 p refs
(Contract DI-14-31-0001-5254)
(PB-263091/1; Arid Lands Resource-IP-8; W77-03966; OWRT-A-197(5254)(1)) Avail: NTIS HC A10/MF A01 CSCL 08I

A literature review with its annotated bibliography is presented by taking into account the unusual developments in this field in the interim, new geothermal fields discovered, new demands for geothermal energy as an alternative source to more conventional sources, and a number of new publications reflecting accelerated research. GRA

N77-23593# California Univ., Riverside. Inst. of Geophysics and Planetary Physics.

TELLURIC MAPPING OVER THE MESA GEOTHERMAL ANOMALY, IMPERIAL VALLEY, CALIFORNIA

John P. Maas 1975 12 p refs Sponsored by NSF
(PB-262828/7; IGPP-UCR-75-10; NSF/RA/N-75-361) Avail: NTIS HC A02/MF A01 CSCL 08I

Telluric measurements were made at thirty-nine stations in the vicinity of the Mesa Geothermal Anomaly, Imperial Valley, California to evaluate the usefulness of the method as a geothermal prospecting tool. The area of investigation is characterized by thick (about 3 km) and highly conductive (resistivity on the order of 5 ohm-m) sediments. Relative ellipse areas were determined for the stations and plotted as total field and residual contour maps. These maps clearly reveal the presence of the thermal anomaly. They coincide well in geometry with the anomaly shown by shallow thermal gradient data and are consistent with temperature data from five deep wells in the area. GRA

N77-23594# Hawaii Univ., Honolulu. Geothermal Project.

THE HAWAII GEOTHERMAL PROJECT, INITIAL PHASE 2 PROGRESS REPORT

John W. Shupe, Augustine S. Furumoto, Paul C. Yuen, Robert M. Kamins, and Gordon A. MacDonald Feb. 1976 156 p refs Sponsored by NSF, ERDA, State of Hawaii, and County of Hawaii
(PB-263120/8; NSF/RA-760401) Avail: NTIS HC A08/MF A01 CSCL 08I

The identification, generation, and utilization of geothermal energy on the island of Hawaii are discussed. Overviews of four separate research programs are presented. GRA

N77-23595# New Mexico State Univ., University Park. Water Resources Research Inst.

APPLICATION OF ENVIRONMENTAL TRITIUM IN THE MEASUREMENT OF RECHARGE AND AQUIFER PARAMETERS IN A SEMI-ARID LIMESTONE TERRAIN Completion Report

Gerardo Wolfgang Gross, Roberta N. Hoy, and Christopher J. Duffy Nov. 1976 225 p refs Prepared in cooperation with New Mexico Inst. of Mining and Technology
(Contract DI-14-31-0001-4107)
(PB-263289/1; WRRI-080; W77-04106; OWRT-B-041-NMEX(1)) Avail: NTIS HC A10/MF A01 CSCL 08H

This project is part of a continuing inquiry into regional patterns of recharge and groundwater flow. Starting from the hydrologic model established in a previous investigation, this phase has concentrated on determinations of environmental tritium in the basin's recharge belt. Special attention was given to the southern part of the study area where tritium peaks predicted by the model apparently had failed to materialize. For the sampled wells, all available information on depth and geologic character of water-bearing horizons, as well as construction and history of each well were collected and summarized. The areal precipitation over the basin was recomputed for the year 1955-1974, and statistics on surface runoff have been assembled. Tritium concentrations in groundwater from the Recharge Belt are, on the whole, lower than might be expected from the Model. Also, in considerable parts of the Recharge Belt the groundwater is confined. The distribution of environmental tritium within the basin itself, both in time and space, suggests that interaquifer leakage is an important factor in these patterns. GRA

N77-23596# Wyoming Univ., Laramie. Water Resources Research Inst.

DEVELOPMENT OF COMMERCIAL/INSTITUTIONAL PARAMETER UNITS FOR THE MAIN II SYSTEM OF WATER DEMAND FORECASTING

A. Gerald Thompson, Verne E. Smith, and William R. Colvin Nov. 1976 60 p refs
(Contract DI-14-31-0001-5220)
(PB-263493/9; W77-04182; OWRT-C-6188(5220)(1)) Avail: NTIS HC A04/MF A01 CSCL 13B

Commercial/institutional data were collected for 20 cities in the western United States. Analysis led to the development of linear relationships to predict commercial/institutional parameters from population. Geographic regions and classification by city size were not found to be significant factors. The MAIN 2 (Municipal And Industrial Needs) water forecasting computer model was modified to include the option of estimating commercial/institutional parameters if the data are not input. Application of the modified model to three test cities gave very good results. GRA

N77-23597# Federal Power Commission, Washington, D. C. Bureau of Natural Gas.

PRELIMINARY INVESTIGATION. NONPRODUCING GAS RESERVES ONSHORE UNITED STATES AND IN THE GULF OF MEXICO OFFSHORE STATE AREA, AS REPORTED IN FEDERAL COMMISSION FORM 15

16 Sep. 1976 24 p refs
(PB-263434/3) Avail: NTIS HC A02/MF A01 CSCL 08I

Non-producing dedicated gas reserves onshore United States and in the Gulf of Mexico offshore state area are discussed. The result of an investigation undertaken to determine the extent of nonproducing interstate reserves is reported in FPC Form 15 (natural gas companies' annual report of gas supply). GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N77-23598 Auburn Univ., Ala.
TWO INVESTIGATIONS OF FLAT-PLATE SOLAR COLLECTOR PERFORMANCE Ph.D. Thesis
Jeffrey Herbert Morehouse 1976 163 p
Avail: Univ. Microfilms Order No. 77-4316

The heat loss from an operating solar collector is calculated from the experimentally determined equilibrium (no flow) heat transfer loss coefficient. Collector efficiency is then calculated for the cases when absorber plate temperature, average fluid temperature, and inlet fluid temperature are chosen as the independent parameters. A method for producing high temperatures using flat-plate collectors is presented. A radiation trap is described which mechanically reduces the effective emissivity of the absorber plate at a given temperature by reflecting some of the emitted radiation back onto the emitting surface. Circular and rectangular trap geometries are analyzed for absorber surface equilibrium temperature as a function of trap geometry and insolation value. Dissert. Abstr.

N77-23599 California Univ., Berkeley.
FERMENTATION KINETICS AND PROCESS ECONOMICS FOR THE PRODUCTION OF ETHANOL Ph.D. Thesis
Gerald Raymond Cysewski 1976 294 p
Avail: Univ. Microfilms Order No. 77-4428

Fermentation technology for the production of ethanol was optimized. Using glucose as the fermentable substrate, optimal fermentation parameters of pH, temperature, oxygen tension and sugar concentration were determined in both batch and continuous culture. The experimental results indicate that although ethanol fermentation is an anaerobic process, trace amounts of oxygen are required for maximal ethanol production. Continuous ethanol production by the adapted yeast was found to be 43% higher than for the unadapted yeast under conditions of complete substrate utilization. The pH of the broth had only a slight effect on fermentation rates between 3.5 and 5.5. However, the sugar concentration did affect ethanol productivities in continuous culture, with the optimal concentration being 10 wt% sugar. A cell recycle system employing an external settler to increase the biomass concentration was increased fourfold in the recycle system over conventional continuous operations. This produced a corresponding fourfold increase in ethanol productivity.
Dissert. Abstr.

N77-23600 Montana State Univ., Missoula.
MAGNETOHYDRODYNAMIC/STEAM SYSTEM DYNAMIC MODELING AND CONTROL Ph.D. Thesis
John Donald Aspnes 1976 295 p
Avail: Univ. Microfilms Order No. 77-4977

Three dynamic computer models of an overall magnetohydrodynamic/steam electrical power generating plant are developed. Time domain solutions to the three sets of system equations are given. The three models are generated in an increasing order of complexity. Several control configurations are applied to the systems and their effects on system dynamic response are presented. The most detailed model utilizes an input-output characterization of the combustor/nozzle/channel/diffuser developed from polynomial approximations of data resulting from the solution of energy balance, state, and continuity equations for the combustor. The boiler and turbine valve model has turbine valve area and power available to generate steam as inputs, and throttle pressure, power to the turbine, and boiler and stack losses as outputs. Dissert. Abstr.

N77-23601+ European Space Research and Technology Center, Noordwijk (Netherlands).
INVESTIGATION OF A CTS SOLAR CELL TEST PATCH UNDER SIMULATED GEOMAGNETIC SUBSTORM CHARGING CONDITIONS
K. P. Bogus 1976 23 p refs Presented at the USAF/NASA Spacecraft Charging Technol. Conf., Air Force Acad., Colo., 27-29 Oct. 1976
Avail: NTIS HC A02

A series of post-launch tests has been performed in order to study the behavior of the CTS solar cell test patch under simulated geomagnetic substorm conditions. The results of these tests are presented. Discharges due to electrostatic charging of the solar cell test patch rearside under electron irradiation occur at electron energies above 15 keV but only if the test patch frontside is not sun-illuminated. Under solar illumination the discharge rate decreases to zero, and no discharges are obtained up to 20 keV electron energy. It could be shown that the solar array temperature is strongly influencing the discharge rate and that only below a certain threshold temperature around 30 C discharges can be obtained. Moreover, the illumination level on the array frontside influences the threshold temperature such that it is reduced to less than 0 C at 0.5 solar contents. The test results indicated that the experiment electronics will not survive a severe discharge in the test patch area. Since the experiment is operating properly in space up to now, it is considered that no severe discharges have occurred yet in the critical area. Author (ESA)

N77-23602*# Dow Chemical Co., Walnut Creek, Calif.
THE DEVELOPMENT OF A POTASSIUM-SULFIDE GLASS FIBER CELL AND STUDIES ON IMPURITIES IN ALKALI METAL-SULFUR CELLS
F. Y. Tsang Jan. 1977 35 p refs
(Contract NAS3-18525)
(NASA-CR-135144) Avail: NTIS HC A03/MF A01 CSCL 10A

Potassium sulfur rechargeable cells, having as the electrolyte the thin walls of hollow glass fibers made from permeable glass, were developed. The cells had short lives, probably due to the construction materials and impurities in the potassium. The effect of the impurities in the analogous NA-S system was studied. Calcium, potassium, and NaOH/oxide impurities caused increased resistance or corrosion of the glass fibers. For long lived cell operation, the Na must contain less than 1 ppm Ca and less than a few ppm of hydroxide/oxide. Up to 150 ppm K can be tolerated. After purification of the Na anolyte, cell lifetimes in excess of 1000 deep charge-discharge cycles or over 8 months on continuous cycling at 10-30 percent depth of discharge were obtained. Author

N77-23603*# Rockwell International Science Center, Thousand Oaks, Calif.
DEVELOPMENT OF AN (AlGaAs-Ga As) GRADED BAND GAP SOLAR CELL Final Report, 23 Oct. 1974 - 1 Oct. 1976
R. Sahai and J. S. Harris, Jr. Dec. 1976 63 p refs
(Contract NAS1-13548)
(NASA-CR-145161; SC5005.46FR) Avail: NTIS HC A04/MF A01 CSCL 10A

The results of an experimental program to develop the epitaxial growth techniques and analytical characterization techniques to fabricate graded bandgap solar cells are reported. Author

N77-23604*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE NASA THERMIONIC-CONVERSION (TEC-ART) PROGRAM
James F. Morris 1977 19 p refs Presented at Plasma Sci. Conf., Troy, N. Y., 23-25 May 1977; sponsored by IEEE
(NASA-TM-X-73610; E-9093) Avail: NTIS HC A02/MF A01 CSCL 10A

The current emphasis is on out-of-core thermionic conversion (TEC). The additional degrees of freedom offer new potentialities, but high-temperature material effects determine the level and lifetime of TEC performance: New electrodes not only raise power outputs but also maintain them regardless of emitter-vapor deposition on collectors. In addition, effective electrodes serve compatibly with hot-shell alloys. Space TEC withstands external and internal high-temperature vaporization problems, and

terrestrial TEC tolerates hot corrosive atmospheres outside and near-vacuum inside. Finally, reduction of losses between converter electrodes is essential even though rather demanding geometries appear to be required for some modes of enhanced operation.
Author

N77-23605*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMOCHEMICAL CYCLE ANALYSIS USING LINKED CECS72 AND HYDRGN COMPUTER PROGRAMS
Leo F. Donovan May 1977 40 p refs
(NASA-TM-X-73667; E-9191) Avail: NTIS HC A03/MF A01 CSCL 10A

A combined thermochemical cycle analysis computer program was designed. Input to the combined program is the same as input to the thermochemical cycle analysis program except that the extent of the reactions need not be specified. The combined program is designed to be run interactively from a computer time-sharing terminal. This mode of operation allows correction or modification of the cycle to take place during cycle analysis. A group of 13 thermochemical cycles was used to test the combined program. Author

N77-23606*# Coppin State College, Baltimore, Md.
CADMIUM MIGRATION IN AEROSPACE NICKEL CADMIUM CELLS
Patrick D. McDermott Mar. 1976 33 p refs
(Grant NsG-5051)
(NASA-CR-144753) Avail: NTIS HC A03/MF A01 CSCL 10C

The effects of temperature, the nature of separator material, charge and discharge, carbonate contamination, and the mode of storage are studied with respect to the migration of active material from the negative toward the positive plate. A theoretical model is proposed which takes into account the solubility of cadmium in various concentrations of hydroxide and carbonate at different temperatures, the generation of the cadmiate ion during discharge, the migration of the cadmiate ion and particulate Cd(OH)2 due to electrophoretic effects and the movement of electrolyte in and out of the negative plate and, finally, the recrystallization of the cadmiate ion in the separator as Cd(OH)2. Application of the theoretical model to observations of cadmium migration in cycled cells is also discussed. Author

N77-23607# Pope, Evans, and Robbins, Inc., New York. Div. of Solar Energy.
SITE ENERGY HANDBOOK. VOLUME 1: METHODOLOGY FOR ENERGY SURVEY AND APPRAISAL
Oct. 1976 180 p refs
(Contract E(49-1)-3853)
(ERDA-76/131/1) Avail: NTIS HC A09/MF A01

The site energy survey and appraisal methodology and forms, as well as the site energy conservation opportunities presented in the Handbook, cover energy entering the site, energy generated on site, energy distributed and consumed on the site, and waste energy recovery. ERA

N77-23608# Energy Research and Development Administration, Washington, D.C. Div. of Solar Energy.
SITE ENERGY HANDBOOK. VOLUME 2: FORMS FOR ENERGY SURVEY AND APPRAISAL
Oct. 1976 271 p refs
(Contract E(49-1)-3853)
(ERDA-76/131/2) Avail: NTIS HC A12/MF A01

Forms are presented for use in describing, surveying, and appraising site energy, utility, and recoverable waste energy systems for natural gas, fuel oil, LPG, coal, electricity, steam, hot water, chilled water, compressed air, water supply, steam condensate, wastewater and solid waste. ERA

N77-23609# Oak Ridge National Lab., Tenn.
DEVELOPMENT AND APPLICATIONS OF SPATIAL DATA RESOURCES IN ENERGY RELATED ASSESSMENT AND PLANNING
R. J. Olson, F. G. Goff, and J. S. Olson 1976 9 p refs Presented at Proc. of the Advan. in Retrieval Technol. as Related to Inform. Systems, Arlington, Va., 20 Oct. 1976
(Contract W-7405-eng-26)
(CONF-761017-1) Avail: NTIS HC A02/MF A01

An investigation of potential changes in vegetation patterns related to predicted temperature changes from increased atmospheric CO2 is presented to illustrate an ongoing application of the data resources. Other themes include coal extraction in Appalachia, landscape patterns, habitat and population dynamics of selected biological species, and energy facility siting. ERA

N77-23610# California Univ., Livermore. Lawrence Livermore Lab.
THE 120-keV BEAM DIRECT CONVERSION SYSTEM FOR TFTR INJECTORS
G. W. Hamilton 21 Sep. 1976 20 p refs
(Contract W-7405-eng-48)
(UCRL-52137) Avail: NTIS HC A02/MF A01

A preliminary design is presented in which the most acute problems involved in scaling up existing designs and apparatus to fulfill TFTR requirements are analyzed. The requirements for electron suppression, gas pumping, compactness, and power densities are addressed. An idea is presented that allows for the handling of higher beam power. The gross savings in the capital cost of injector power supplies for the TFTR will be about $7.2 million, but the net savings will be somewhat less than this. ERA

N77-23611# European Space Research and Technology Center, Noordwijk (Netherlands).
CHARGE EFFICIENCY OF SEALED Ni/Cd CELLS
P. Montalenti Paris ESA Jan. 1977 37 p refs
(ESA-TN-136) Avail: NTIS HC A03/MF A01

Data on the charge efficiency of nickel/cadmium cells are presented, derived both from the literature and from extensive testing performed in the ESTEC battery laboratory. It is shown that the same basic charge efficiency data apply to spacequalified, sealed, sinter-plate, positive limited NiCd cells from different manufacturers. The possibility of interpolating existing experimental data into draft charge efficiency diagrams for any possible spacecraft cycling operating condition is highlighted. On the basis of test results a correlation is made between instantaneous charge efficiency and other operating parameters such as cell voltage, temperature, and pressure variation during charge. Author (ESA)

N77-23612# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
RADIATION DAMAGE IN THIN SILICON CELLS MANUFACTURED FROM VARIOUS BASE MATERIALS Final Report [ETUDE DES DEGATS DE RADIATION DANS LES CELLULES MINCES AU SILICIUM FABRIQUEES A PARTIR DE DIFFERENTS MATERIAUX DE BASE]
J. Bernard Dec. 1976 80 p refs In FRENCH
(Contract ESTEC-2062/73-AK)
(ESA-CR(P)-918) Avail: NTIS HC A05/MF A01

Thin silicon solar cells, manufactured from 11 types of p silicon were subjected to 1 MeV electron flux and 2.5 MeV and 20 MeV proton flux. The cells were periodically irradiated with photons for 48 hours. The IV characteristics and the diffusion lengths of minority carriers were measured after each irradiation. A relation between the diffusion length and the particle flux was found. The impurity concentrations of O, C, B, Al, and p in the silicon were measured by nuclear activation analysis, infrared spectroscopy, and Hall effect. No correlation was observed between photon degradation and the nature of the impurities.
ESA

N77-23613# Defence Research Establishment Ottawa (Ontario).
A COMPUTER PROGRAM TO CALCULATE AND PLOT WIND-GENERATED STORED ENERGY AT CONSTANT CONSUMPTION
E. M. L. Valeriote Jun. 1976 46 p
(AD-A029977; DREO-TN-76-15) Avail: NTIS HC A03/MF A01 CSCL 09/2

A computer program has been described which gives printed and plotted outputs of the quantity of wind-generated energy remaining in a storage system under given conditions. The program permits simulated variations of storage capacity, constant electrical load and conversion efficiency by simple data changes. Further alterations to the program itself are

detailed, to adapt it to carry out similar calculations for wind turbines of various sizes of construction. The program has been tested by simulation of a hypothetical system of energy production, storage and consumption. It is planned that its predictions will be compared with data obtained from an experimental program currently in progress. Author (GRA)

N77-23614# Booz-Allen and Hamilton, Inc., Bethesda, Md.
PROCEDURES FOR FEASIBILITY ANALYSIS AND PRELIMINARY DESIGN OF TOTAL ENERGY SYSTEMS AT MILITARY FACILITIES Final Report
Nov. 1976 140 p refs
(Contract N62399-74-C-0029; DA Proj. 4A7-62720-A-896)
(AD-A033756; CERL-TR-E-96) Avail: NTIS HC A07/MF A01 CSCL 13/1

This manual provides procedural guidance and technical information for performing feasibility analyses and preliminary design of heat recovery installations, especially total energy and selective energy utility plants. This document is intended for use by facility and district engineers and for guidance of headquarters personnel. The feasibility analysis procedure is divided into five major steps: (1) identification of gross energy requirements; (2) assessment of the viability of heat recovery within the project environment; (3) assessment of user system constraints and energy requirements--(Site analysis and selection, load analysis); (4) definition of candidate system configurations; (5) technical and economic evaluation of candidate systems--(Energy efficiency analysis, economic analysis). GRA

N77-23615# Naval Research Lab., Washington, D. C.
GEOPHYSICAL FLUID DYNAMICS BACKGROUND FOR OCEAN THERMAL POWER PLANTS Interim Report
Steve A. Piacsek, Juri Toomre, and Glyn O. Roberts Oct. 1976 78 p refs
(Contract E(49-26)-1005)
(AD-A033831; NRL-MR-3392) Avail: NTIS HC A05/MF A01 CSCL 08/10

The vertical temperature gradient in the tropical oceans can be used to operate ocean thermal power plants (OTPP's) that function as heat engines. Such energy extraction would entail very large scale pumping of both warm surface water and cold bottom water through heat exchangers, with consequent disturbance and extensive mixing of surface and deep waters. The temperature difference between the warm and cold inflow water should be maximized for plant efficiency, but entrainment and recirculation between the inflow and the outflow may reduce this temperature contrast. Further, horizontal currents and turbulence carry the outflow water to large distances and may produce significant changes. These flows are crucial in determining the thermal resource availability and the environmental impact of OTPP operation. This report provides background material and brief assessments in several areas of geophysical fluid dynamics (GFD) that bear directly on these problems. Relevant GFD research areas discussed include: turbulence and thermal wakes; ocean circulation and the permanent thermocline; air-sea interaction and thermocline variation; weather and climate modeling; and marine ecosystems. The report illustrates how each GFD area relates to specific OTPP problems, and emphasizes the multiple disciplines in GFD that must be considered.
Author (GRA)

N77-23616# National Bureau of Standards, Washington, D. C. Office of Energy Conservation.
ENERGY MANAGEMENT GUIDE FOR LIGHT INDUSTRY AND COMMERCE. EPIC ENERGY MANAGEMENT SERIES Final Report
W. J. Kelnhofer (Catholic Univ. of America, Washington, D. C.) and L. A. Wood Dec. 1976 31 p refs
(PB-263121/6; NBS-HB-120; LC-76-608281) Avail: NTIS HC A03/MF A01 CSCL 13A

Methods by which the manager of a small business can analyze his energy use, and determine the areas in which energy savings can be made are reported. The magnitude of the possible cost savings is estimated. A check list suggests some seventy items which might be important cost saving opportunities to an individual business. Eight of these opportunities are expanded in the appendix into miniature case studies illustrating simple methods for estimating savings. A listing of sources of assistance is included as a guide to obtaining consulting advice. GRA

N77-23617# Federal Power Commission, Washington, D. C. Bureau of Power.
THE PHASING OUT OF NATURAL GAS AND OIL FOR ELECTRIC POWER GENERATION, SOUTHWEST POWER POOL AND ELECTRIC RELIABILITY COUNCIL OF TEXAS. PART 2: TECHNICAL AND ECONOMIC EVALUATION OF VARIOUS POSSIBLE ELECTRIC UTILITY NATURAL GAS REDUCTION PROGRAMS, 1975 - 1990
30 Jul. 1976 250 p refs
(PB-263505/0) Avail: NTIS HC A11/MF A01 CSCL 10A

The technical and economic feasibility of programs for accelerating the phasing out of natural gas consumption by electric utilities in the southwest U.S. between 1975 and 1990 is evaluated. GRA

N77-23618# Sowle (Don) Associates, Inc., Arlington, Va.
A FEDERAL PROCUREMENT PLAN TO ACCELERATE USE OF SOLAR ENERGY
Dec. 1976 100 p
(Contract FEA-CO-05-50293-00)
(PB-263369/1; FEA/G-77/044) Avail: NTIS HC A05/MF A01 CSCL 05A

The Solar Energy Government Buildings Program (SEGEP) is a major commercialization project being developed by the Federal Energy Administration in conjunction with other agencies. This project will use a portion of the vast inventory of Federal buildings to provide an early and significant market for solar heating and hot water equipment and thus assist the early development of a solar heating and cooling industry infrastructure. This report addresses key features of Government procurement as part of an overall implementation plan for the SEGEP. The report reviews trends and techniques in Government procurement, discusses alternative strategies, and sets forth procurement plan to achieve SEGBP goals and objectives. GRA

N77-23619# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
METHANOL AS AN AUTOMOTIVE FUEL: A SUMMARY OF RESEARCH IN THE M.I.T. ENERGY LABORATORY Final Report
Richard G. Donnelly, John B. Heywood, Jules LoRusso, Frank OBrien, Thomas B. Reed, and Rodney J. Tabaczynski Apr. 1976 57 p refs
(PB-262980/6; MIT-EL-76-013) Avail: NTIS HC A04/MF A01 CSCL 21D

The current status of studies on the use of methanol blends as automotive fuels is briefly reviewed. Experiments with a single-cylinder spark-ignition engine that methanol-gasoline blends show emissions and efficiency closely comparable to gasoline alone and that the blends yield a slight extension of the lean limit of operation. Methanol alone significantly extends the lean limit of operation and permits operation at much higher compression ratios with corresponding improvements in efficiency. GRA

N77-23620# Federal Power Commission, Washington, D. C. Office of Energy Systems.
STATE PROJECTIONS OF INDUSTRIAL FUEL NEEDS
Marquis R. Seidel Aug. 1976 136 p refs
(PB-263338/6) Avail: NTIS HC A07/MF A01 CSCL 21D

The issue of how higher fuel prices and conservation will change economic growth and fuel use at state and regional levels is addressed. The assembly of detailed and consistent data on fuel use, cross-sectional regressions on that data, and extrapolation of fuel requirements for 1990's economy are discussed. GRA

N77-23621# Federal Power Commission, Washington, D. C. Bureau of Natural Gas.
THE FUTURE OF NATURAL GAS: ECONOMIC MYTHS, REGULATORY REALITIES
S. William Yost Nov. 1976 30 p
(PB-263625/6) Avail: NTIS HC A03/MF A01 CSCL 21D

Conventional gas supplies (excluding Alaskan) past the year 2000 as well as the potential for supplementary supplies from

Alaskan gas, LNG, and coal gasification during the same period are forecasted. The costs for these supplies are calculated, in constant dollars, for 1985 and 2000 using estimated quantities of new gas and rollover gas under existing FPC Opinions for these years. The prices of alternate fuels are also estimated, using the price rollup for crude and the expiration of contracts for coal. GRA

N77-23622# Hawaii Univ., Honolulu. Coll. of Engineering.
REGENERATIVE VAPOR CYCLE WITH ISOBUTANE AS WORKING FLUID
James C. S. Chou, Rajesh K. Ahluwalia, and Eric Y. K. Woo 10 Jun. 1974 32 p refs
(Grant NSF GI-38319)
(PB-262704/0; HGP-TR-4; NSF/RA/N-74-326) Avail: NTIS HC A03/MF A01 CSCL 08I

A regenerative heat exchanger, the increase in power production, and the reduction of the sizes of cooling equipment were investigated. Geothermal fluid from a well may exist in two phases, vapor and liquid, if the fluid is self-flowing. To avoid scaling, a submersible pump may be used to force the fluid out of the well. Effects of pumping on the power output and heat rejection of a binary cycle have also been evaluated with a specific set of given conditions, and the calculated results are included in this report. GRA

N77-23623# Washington Univ., St. Louis, Mo. Dept. of Systems Science and Mathematics.
LOCALIZED SYSTEM WIDE STABILITY AUGMENTATION FOR LARGE INTERCONNECTED POWER SYSTEMS, PART 1 AND PART 2
J. Zaborszky, T. J. Tarn, and A. K. Subramanian Jul. 1975 193 p refs
(Grant NSF GI-34969)
(PB-263517/5; SSM-7401-Pt-1; SSM-7401-Pt-2; NSF/RA/N-75-369) Avail: NTIS HC A09/MF A01 CSCL 10B

Three control schemes are proposed and the conditions of their stabilizing action are established in this report. All three schemes are realizable and all can use any of the existing stability augmentation devices (resistors, reactors, capacitors, dc lines, fast valving, excitation control). The results reported here make it possible to use these devices system-wide, with local control in a coordinated manner. GRA

N77-23624# Rutgers - The State Univ., New Brunswick, N. J. Dept. of Electrical Engineering.
SILICON SCHOTTKY PHOTOVOLTAIC DIODES FOR SOLAR ENERGY CONVERSION Quarterly Progress Report, 1 Jul. - 30 Sep. 1976
William A. Anderson Oct. 1976 28 p refs
(Grant NSF AER-73-03197)
(PB-263172/9; NSF/RANN/SE/AER73-03197/PR-76; NSF/RA-760223) Avail: NTIS HC A03/MF A01 CSCL 10B

Fabrication studies have been made to evaluate electron-beam deposition of new Schottky metals, screem printed grids, and Tyco silicon. Schottky cells on Tyco silicon have been made with V sub ohm current = 0.5 V and an efficiency of 5.7%. Surface-state analysis continues to give a good agreement between experiment and theory. AR coating studies include sputtered ITO, spin-on coatings, and electron beam-evaporated Ta2O5. Environmental testing of cells has continued during this past quarter. GRA

N77-23625# Oklahoma State Univ., Stillwater. School of Electrical Engineering.
DEVELOPMENT AND ADAPTATION OF FIELD MODULATED GENERATOR SYSTEMS FOR WIND ENERGY APPLICATIONS Progress Report
R. Ramakumar, William L. Hughes, H. Jack Allison, R. K. Yarlagadda, and G. G. Smith 17 Oct. 1975 135 p refs
(Grant NSF AER-75-00647)
(PB-263604/1; NSF/RA/N-74-373) Avail: NTIS HC A07/MF A01 CSCL 10B

A specially designed test machine has been fabricated for the experimental investigation. The stator and rotor are being wound. The solid state inverter required for this system is being assembled in a conveniently transportable rack for testing. Parallel-bridge rectifier system studies were extended to include bridge-input capacitors for the case of resistive loads. Fourier analysis of source current and load current waveforms has been completed, and the results are presented in graphical form for different values of ratios. GRA

N77-23626# EIC, Inc., Newton, Mass.
STUDY OF SILICA SCALING FROM GEOTHERMAL BRINES Semiannual Progress Report, 15 May - 14 Nov. 1975
W. W. Harvey, P. OD. Offenhartz, G. F. Pearson, and J. Slaughter Jan. 1976 58 p refs Sponsored in part by NSF
(Contract E(11-1)-2607)
(PB-262890/7; NSF/RA-760397; COO-2607-2) Avail: NTIS HC A04/MF A01 CSCL 08I

Concurrent analyses for silicic acid monomer and total dispersed silica in a 2% brine at 95C and pH5 reveal a growth and decay of nonmonomeric silica concentration superimposed on the disappearance of monomer. The observed sequence suggests that monomer combines with polymeric species, and the latter grow and aggregate into flocculent silica or scale. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N77-23627 California Univ., Davis.
THE USE OF X-RAY FLOURESCENT SPECTROSCOPY FOR MONITORING HEAVY METALS IN AQUATIC ENVIRONMENTS Ph.D. Thesis
Thomas Howard Sibley 1976 166 p
Avail: Univ. Microfilms Order No. 77-6362

Spatial and temporal variation of trace metal concentration in seston was studied at four stations in Lake Berryessa. Samples from six stations were analyzed. Differences between stations indicated effects of stream runoff and recreational development. Throughout the monitoring program manganese concentrations were higher in areas with more runoff. Concentrations of titanium, chromium, iron, rubidium, zirconium and strontium also increased due to runoff following a Spring storm. In general, titanium, rubidium, zirconium and strontium seem to occur primarily with inorganic solids. High concentrations of iron and manganese may occur as metal oxide precipitates; chromium probably is adsorbed on inorganic surfaces. Recration development contributes to high concentrations of chromium, lead and nickel. The causes and significance of spatial and temporal variation are discussed. Dissert. Abstr.

N77-23628*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PROCEEDINGS OF THE SPACE SHUTTLE ENVIRONMENTAL ASSESSMENT WORKSHOP ON TROPOSPHERIC EFFECTS
Burton G. Cour-Palais, comp. Feb. 1977 209 p refs Proc. held at Houston, Tex., 17-18 May 1976
(NASA-TM-X-58199; JSC-11769) Avail: NTIS HC A10/MF A01 CSCL 13B

Various aspects of the environmental effect of space shuttle exhaust, sonic boom, and launch noise are presented. Author

N77-23629# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
DEVELOPMENT OF AN INFRARED ANALYZER FOLLOWING THE BIFREQUENCY PRINCIPLE FOR AUTOMATIC AND CONTINUOUS MEASUREMENT OF GASEOUS EMISSIONS
J. Marckmann Jun. 1976 72 p In GERMAN
(BMFT-FB-T-76-22) Avail: NTIS (US Sales Only) HC A04/MF A01; ERDA Depository Libraries

A dispersive infrared analyzer following the bifrequency-principle for automatic and continuous measurement of gaseous emissions has been developed. The instrument quantitatively scans the concentration of a sample gas component by measuring the absorption of a characteristic infrared band of the sample relative to the background absorption at a reference frequency. The

instrument sequentially scans the concentration of up to 4 components. The spectral range may be modified by the exchange of different gratings and detectors. The optical layout allows the use of different infrared liquid cells and special accessories as well as of longpath gas cells. The system is completed by the gas probe with heated coarse and fine gas filters, heated gas tubings and a gas pump. ERA

N77-23630# Iowa State Univ. of Science and Technology, Ames.
SORPTION OF POLLUTANT GASES BY SOILS Progress Report, 1 Dec. 1975 - 30 Nov. 1976
J. M. Bremner Aug. 1976 8 p refs
(Contract E(11-1)-2530)
(COO-2530-7) Avail: NTIS HC A02/MF A01

Gas chromatographic studies showed that soils have a substantial capacity for sorption of N2O and may represent an important natural sink for atmospheric N2O. Sorption of N2O by soils is a microbial process involving reduction of N2O to N2. It is promoted by anaerobic conditions and by organic substances that promote growth of soil microorganisms. Nitrogen isotope discrimination during denitrification of nitrate in soils was found to be of sufficient magnitude to invalidate the use of N isotope-ratio analyses for assessment of the contributions of soil and fertilizer N to nitrate in surface and ground, waters or to N2O in the atmosphere. ERA

N77-23631# Notre Dame Univ., Ind. Dept. of Civil Engineering.
CONTAMINATION OF GROUNDWATER BY HEAVY METALS FROM THE LAND DISPOSAL OF FLY ASH Technical Progress Report, 1 Jun. - 31 Aug. 1976
T. L. Theis 1 Oct. 1976 44 p refs
(Contract E(11-1)-2727)
(COO-2727-4) Avail: NTIS HC A03/MF A01

A useful method of differentiating surface from total heavy metals associated with fly ash is selective extraction for those metal oxide sinks (Fe, Al, Mn) with which the heavy metals have become associated. Lower pH values favor greater release or less adsorption in the system. Solubility, generally decreases with increasing pH. Even at neutral pH values, soluble complexes may increase the concentration of a given metal in excess of solubility. The average percentage of metals released for all fly ashes studied from their surface sinks at pH = 9 were cadmium-17 percent, lead-8 percent, chromium-6 percent, copper-1 percent, and zinc less than 1 percent. Another important factor is the absolute amount of metal on the surface. For instance, even though copper is released very little at neutral pH's, surface concentrations up to 200 micrograms/g of fly ash were found. ERA

N77-23632# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
ECOLOGICAL STABILITY: AN ECOSYSTEM PERSPECTIVE. CLASSICAL AND CURRENT THOUGHTS: REVIEW OF SELECTED LITERATURE
Peter VanVoris Oct. 1976 42 p refs
(Contracts W-7405-eng-26; EPA-INA-IAG-05-0713)
(ORNL/TM-5517; Publ-900) Avail: NTIS HC A03/MF A01

The term stability, in its ecological context, was applied to populations, communities, and, most recently, to ecosystems with such an array of meanings that it has almost become a panchreston. This review of selected literature points out the problems inherent in relying on either static measures (e.g., species diversity, connectivity, or energy balance) as a measure of complexity to arbitrarily rank the relative stabilities of ecosystems, or the dynamic approach of analyzing the mathematical stability of linear or nonlinear models. The research direction emphasizes development of new measures of ecosystem complexity based on ecosystem level characteristics (e.g., nutrient retention, or ecosystem metabolism) and relating these measures of complexity to an a priori defined ecosystem stability. ERA

N77-23633# Utah Water Research Lab., Logan.
AN EMPIRICAL ANALYSIS OF PREDICTORS OF INCOME DISTRIBUTION EFFECTS OF WATER QUALITY CONTROLS
John E. Keith, Ming C. Chen, Don C. Reading, and Robert Johnson Sep. 1976 48 p refs
(Contract DI-14-31-0001-5119)
(PB-262010/2; PRRAE015-1; W77-02833; OWRT-B-115-UTAH(1)) Avail: NTIS HC A03/MF A01 CSCL 13B

Methodologies of measuring income distribution changes, and appropriate methodology and empirically test for the impacts of water quality controls are analysed. The lognormal, displaced lognormal, gamma, and beta distribution functions were considered as appropriate methodologies. A simultaneous equation econometric model was constructed, using a factor-share approach for wage and price changes. Water quality controls were introduced in the model through effects on wages and mean family income, and the latter variables were included in equations estimating the two parameters of the beta distribution function. GRA

N77-23634# ARO, Inc., Arnold Air Force Station, Tenn.
EVALUATION OF PROBE SAMPLING VERSUS OPTICAL IN SITU MEASUREMENTS OF NITRIC OXIDE CONCENTRATIONS IN A JET ENGINE COMBUSTOR EXHAUST Final Report, 2 Jul. 1974 - 16 Feb. 1975
J. D. Few, R. J. Bryson, and W. K. McGregor AEDC Jan. 1977 45 p refs Sponsored by Air Force
(ARO Proj. R32-P55A)
(AD-A034726; ARO-ETF-TR-76-76; AEDC-TR-76-180) Avail: NTIS HC A03/MF A01 CSCL 13/2

Measurements of nitric oxide (NO) concentrations were made at the exhaust of a jet engine combustor by conventional gas-sampling probe and chemiluminescent analyzer methods, by optical resonance absorption through absorption cells located within the gas sample transfer line, and by optical resonance absorption directly through the combustor exhaust. The combustor was exhausted to atmospheric pressure and was operated at an inlet temperature near 600F, a total pressure of about 3 to 4 atm, and at fuel-to-air ratios (f/a) from 0.01 to 0.05. A tubular inlet, liquid-cooled, stainless steel sampling probe was inserted into the gas stream at the combustor exit. The optical technique used was the resonance absorption method for the (0,0) gamma-band of NO at wavelengths ranging from 2,200 to 2,270 A. The results showed that within the sampling line both the chemiluminescent gas analyzer and the optical absorption method gave NO concentrations that agreed within about 20 percent. GRA

N77-23635# Harry Diamond Labs., Adelphi, Md.
RESEARCH AND DEVELOPMENT ASSESSMENT ON SAFETY AND POLLUTION CONTROL FOR OUTER CONTINENTAL SHELF OPERATIONS Final Report
Maurice F. Funke and Bruce A. Weber Dec. 1976 51 p refs Sponsored in part by Geological Survey
(HDL Proj. A50634)
(AD-A034727; HDL-TR-1780) Avail: NTIS HC A04/MF A01 CSCL 08/9

An investigation has been made of the research, development, and data gathering that would provide some of the tools, both information and hardware, that could be used to increase safety and decrease pollution hazards associated with offshore oil and gas exploration and production. Methods have been identified for reducing the dangers to which both workers and structures are exposed during drilling, subsurface production, and transportation operations. These dangers include fire and explosion, asphyxiation, blowout, pollution, and unsafe rig conditions. GRA

N77-23636# Department of Transportation, Washington, D.C. Office of the General Counsel.
AVIATION NOISE ABATEMENT POLICY
18 Nov. 1976 65 p refs
(PB-262916/0; DOT-TCG-77-1) Avail: NTIS HC A04/MF A01 CSCL 13B

Recommendations are made knowing the constraints of technology, productivity and financing. The responsibility of the federal government to reduce aircraft noise at its source is clarified. Safe operational procedures that abate the impact of noise on populated areas are promoted as well as positive efforts to attain compatible land use in areas adjacent to airports. The time that will be required to bring the current fleet of aircraft into compliance with noise level standards that are now technologically feasible

and with the financial requirements necessary to make compliance possible is discussed. GRA

N77-23637# Rohrer (Karl R.) Associates, Inc., Akron, Ohio.
DEMONSTRATION OF VOID SPACE STORAGE WITH TREATMENT AND FLOW REGULATION Final Report, Jan. 1974 - Jan. 1976
Dec. 1976 128 p refs Sponsored by EPA
(PB-263032/5; EPA-600/2-76-272) Avail: NTIS HC A07/MF A01 CSCL 13B

The purpose of this project was to demonstrate and evaluate the feasibility of an underground void space storage tank, in containing and regulating storm overflows from a combined sewer thus reducing the pollution loads discharged to the receiving water body. System design, construction, and two years operation were conducted under the study. The prototype facility was constructed in Akron, Ohio with a combined sewer drainage area of 76.3 hectare (188.5 acres). The tank is of an excavated hopper shape, lined with an impermeable membrane and filled with an inert media. Storage of the waste water is in the void space of the media. After the storm event, the stored stormwater was gravity fed into the interceptor sewer for subsequent treatment. The underground facility was a dual usage concept. In addition to collecting, chlorinating, and detaining potential combined sewer overflows, the facility's top surface could be made usable as a park or recreational grounds. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N77-23638 Princeton Univ., N. J.
NORMAL MODE EXCITATION BY MOMENT TENSORS AND OTHER PHENOMENOLOGICAL DESCRIPTIONS OF SEISMIC SOURCES Ph.D. Thesis
Marjorie Mulcahy 1976 231 p
Avail: Univ. Microfilms Order No. 77-6033

After presenting the general theory for moment tensors and other phenomenological descriptions of seismic sources, the general form of the excitation to the normal modes of the earth is applied. The displacement response of the earth and an analogous form of the strain response of the earth is obtained. These are written in terms of the normal mode displacement eigenfunctions expanded in spherical harmonics and use the spherical harmonic addition theorem to obtain an analytic form of the expansion by summing over azimuthal order. This analytic sum is valid in a spherically symmetric earth. The efficient use of this formalism, and calculate the explicit algebra for working with the faulting of the earth due to a propagating double couple of finite extent are discussed. These calculations can be programmed for comparison with data. Dissert. Abstr.

N77-23639 California Univ., Berkeley.
SPATIAL, TEMPORAL, AND MECHANISTIC CHARACTER IN EARTHQUAKES OCCURRENCE: A SEGMENT OF THE SAN ANDREAS FAULT IN CENTRAL CALIFORNIA Ph.D. Thesis
Karen Cook McNally 1976 177 p
Avail: Univ. Microfilms Order No. 77-4522

Faulting mechanisms have been studied in detail with fault-plane solutions computed for some four hundred earthquakes in this region. Inconsistent first motions were investigated by measuring the angle from the fault plane to the station. These results can be interpreted as lateral refraction of P-waves by the fault-plane velocity discontinuity. The angle of apparent refraction is variable along the fault plane. One explanation is that this phenomenon is an indication of conditions near the source of larger earthquakes. This hypothesis may provide important information regarding the physics of the fracturing process. Dissert. Abstr.

N77-23640 California Univ., Berkeley.
NEAR-FIELD SEISMOGRAMS FROM A TWO-DIMENSIONAL PROPAGATING DISLOCATION Ph.D. Thesis
Joe Jean Litehiser, Jr. 1976 189 p
Avail: Univ. Microfilms Order No. 77-4516

The exact mathematical formulation for displacements on the surface of an isotropic, homogeneous, perfectly elastic half-space due to an embedded line dislocation source is developed. This formulation is then used to model the observed strong-motion accelerometer records generated at Pacoima Dam during the San Fernando earthquake of February 9, 1971. A number of model accelerograms are generated using several dislocation time histories, fault geometries, and fault rupture propagation velocities. The dislocation time histories considered are the simple finite ramp and its first and second order continuous counterparts for rise times of 0.1, 0.25, and 0.5 seconds. Fault rupture propagation velocities are considered over the approximate range of from 2.0 kilometers/second to 2.5 kilometers/second. Dissert. Abstr.

N77-23641 Missouri Univ., Rolla.
A STUDY OF CONDENSATION-FREEZING NUCLEATION OF SMALL WATER DROPLETS IN AN EXPANSION CLOUD CHAMBER EXPERIMENT Ph.D. Thesis
Rodney James Anderson 1976 84 p
Avail: Univ. Microfilms Order No. 77-5558

The homogeneous nucleation of water vapor was observed in an expansion cloud chamber to about -50 C in the carrier gasses argon and helium. The onset of the ice phase in clouds of freshly nucleated drops was shown to occur at final temperatures near -40 C. The critical temperature for ice nucleation depends upon the type of carrier gas, the duration of the minimum final temperature, and whether ions or re-evaporation nuclei are present. These effects and the analysis of the total homogeneous nucleation rate (liquid drops plus ice particles) strongly support the conclusion that the ice particles result from the freezing of liquid water drops which have been nucleated homogeneously from water vapor. Dissert. Abstr.

N77-23642 California Univ., Berkeley.
PRECESSION AND NUTATION OF THE EARTH Ph.D. Thesis
Winston Teitler 1976 105 p
Avail: Univ. Microfilms Order No. 77-4621

The precession and nutation of the earth are determined theoretically, approximating the earth by a rigid body with axial symmetry. Hamiltonian mechanics are used, the set of canonical variables introduced results in relatively simple differential equations, and the theory can be developed conveniently with an electronic computer; the equations are solved by the Von Zeipel method. The values obtained were found to agree with published values obtained by a different method. Dissert. Abstr.

N77-23643 Oklahoma State Univ., Stillwater.
THE GENERALIZED SAGNAC EFFECT WITH THE RING-LASER AND OTHER OPTRADICHES IN THE PPN GRAVITATIONAL THEORY Ph.D. Thesis
Samuel Odell Campbell 1976 86 p
Avail: Univ. Microfilms Order No. 77-5045

An experiment was conducted to measure the dragging of inertial frames effect using two closed loop optical beams traveling in opposite directions an optradich. A theoretical viewpoint based on the Parametrized Post-Newtonian Formalism was developed; the Sagnac Effect was generalized to the Post-Newtonian level of approximation. Numerical results are given for an optradich attached to earth, and for optradiches orbiting Earth, Jupiter, and the sun. The numerical results are so small that it appears quite doubtful that optradich experiments could verify them in the balance of this century. There seem to be a few interesting effects which Schiff's gyroscope at present cannot measure, but which an assumed super optradich can measure. It is believed that efforts should be made ot develop sufficiently sensitive optradiches because of the potential scientific benefits. Dissert. Abstr.

N77-23644 California Univ., Berkeley.
A STUDY OF SUBMERGED AND SURFACE HORIZONTAL BUOYANT JETS Ph.D. Thesis
Atambir Singh Rao 1976 145 p

Avail: Univ. Microfilms Order No. 77-4579

A theroretical and experimental study was made of two classes of buoyant jet problems, as they relate to thermal discharges from power plants to stagnant and non-stratified ambient fluids. A set of entrainment constants and relative spreading ratio for the submerged jet was determined by comparison of theoretical and experimental results for jet centerline temperature decay and jet width. Two different sets of constants were required to define the centerline temperature decay and jet width accurately. The experiments for the surface jet were conducted in the same pool using two discharge pipe diameters. Three dimensional temperature profiles were measured using thermistors, up to a distance of 40 diameters from the discharge. The majority of the temperature profiles were measured however using a remote sensing radiometer. Results using both measurement techniques yielded identical results. Dissert. Abstr.

N77-23645*# Lockheed Electronics Co., Houston, Tex. Services Systems Div.

BALLOON STRATOSPHERIC RESEARCH FLIGHTS, APRIL 1976 TO DECEMBER 1976

Norman C. Allen Mar. 1977 189 p refs

(Contract NAS9-15200)

(NASA-CR-151346; LEC-9905) Avail: NTIS HC A09/MF A01 CSCL 04A

These flights were designed to measure the vertical concentration profile of trace stratospheric species which form major links in the chlorine photochemical system of the upper atmosphere, to measure the vertical concentration profiles of atomic oxygen, the hydroxyl radical and ozone in the stratosphere. An overview of the scientific goals of the program, a statement of program management and support functions, a brief description of the instrumentation flown, pertinent engineering and payload operations data, and a summary of the scientific data obtained for four flights are presented. Author

N77-23646*# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.

STUDY OF DYNAMICS OF MINOR CONSTITUENTS IN THE THERMOSPHERE

Joe M. Straus, Stephen P. Creekmore, and Barbara K. Ching May 1977 137 p refs

(Contract NAS1-14102)

(NASA-CR-145193) Avail: NTIS HC A07/MF A01 CSCL 04A

The global distribution of helium and argon in the terrestrial thermosphere is described. It is based on the extension of a three-dimensional single-fluid numerical model of the thermosphere previously developed by the authors to treat the dynamics of a minor gas imbedded in a background gas made up of N2, O2, and O. Empirical models of the upper atmosphere, based on satellite drag and mass spectrometer data, are used to specify the background gas density and temperature as functions of altitude, latitude, and local time for a given day of the year. Effects of solar activity, eddy diffusion, and exospheric transport on the global distribution of minor gases are investigated.Author

N77-23647*# Naval Research Lab., Washington, D. C. Space Science Div.

SKYLAB EXPERIMENT S063UV AIRGLOW HORIZON PHOTOGRAPHY

Donald M. Packer and Irene G. Packer Oct. 1976 82 p refs

(NASA Order T-88583-O; NRL Proj. A01-38)

(NASA-CR-152841; AD-A032872; NRL-MR-3381) Avail: NTIS HC A05/MF A01 CSCL 04/1

The Skylab space station offered a unique opportunity for man-in-space to study Earth's upper atmosphere from an average 435 km altitude. Experiment S063 made use of 35 mm cameras equipped with various narrow-band filters in the visible and middle ultraviolet spectral range to photograph airglow, aurora and daytime ozone concentrations. Comet Kohoutek was also photographed through various lenses and filters. The present report details the experiment and data deposited at the National Space Science Data Center for use by any scientist who might wish to use the data in further studies. Author (GRA)

N77-23648*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

THERMOSPHERIC TEMPERATURE, DENSITY, AND COMPOSITION: NEW MODELS

L. G. Jacchia 15 Mar. 1977 112 p refs Sponsored by NASA

(NASA-CR-153049; SAO-Special-Rept-375) Avail: NTIS HC A06/MF A01 CSCL 04A

The models essentially consist of two parts: the basic static models, which give temperature and density profiles for the relevant atmospheric constituents for any specified exospheric temperature, and a set of formulae to compute the exospheric temperature and the expected deviations from the static models as a result of all the recognized types of thermospheric variation. For the basic static models, tables are given for heights from 90 to 2,500 km and for exospheric temperatures from 500 to 2600 K. In the formulae for the variations, an attempt has been made to represent the changes in composition observed by mass spectrometers on the OGO 6 and ESRO 4 satellites. Author

N77-23649*# Minnesota Univ., Minneapolis. Tate Lab. of Physics.

RESEARCH OF MAGNETOSPHERIC PHYSICS PHENOMENA USING SOUNDING ROCKETS Semiannual Status Report, 1 Jul. 1976 - 31 Dec. 1977

James E. Steffen 31 Dec. 1976 4 p refs

(Grant NsG-5088)

(NASA-CR-152503) Avail: NTIS HC A02/MF A01 CSCL 04A

A bibliography of approximately 25 papers is presented on the Electron Echo Experiments. The data analysis included an extensive study of the electron accelerator beam, detector data correlations with the electron beam injections, and the study of about 30 onboard detected echoes. S.M.

N77-23650# Regis Coll., Weston, Mass.

[GEOMAGNETIC OBSERVATIONS FROM GREENLAND, 1 JULY 1974 - 31 MARCH 1976] Final Report, 1 Jul. 1973 - 30 Jun. 1976

Dale F. Korff Hanscom AFB, Mass. AFGL 31 Aug. 1976 93 p refs

(Contract F19628-73-C-0259)

(AD-A031494; AFGL-TR-76-0197; Scientific-2) Avail: NTIS HC A05/MF A01 CSCL 08/14

A summary of VLF, magnetometer, riometer, and 5577A photometer ten-minute averaged data from the Geopole Observatory, Thule Air Base, Greenland, for the period 01 July 1974 - 31 March 1976, is presented along with a thirty-second data survey for the same sensors of energetic particle and magnetic disturbance events for the winter seasons 1973-74, 1974-75, and 1975-76. The occurrence of these events in relation to the interplanetary magnetic field sector structure and Godhavn 30 MHz riometer absorption, is discussed. Five energetic particle events are examined in greater detail. An analysis of the 5577A night airglow in the northern Polar Cap is discussed. Author (GRA)

N77-23651# Ohio State Univ., Columbus. Dept. of Geodetic Science.

GEODETIC ACCURACIES OBTAINABLE FROM MEASUREMENTS OF FIRST AND SECOND ORDER GRAVITATIONAL GRADIENTS Interim Report

Klaus-Peter Schwarz Hanscom AFB, Mass. AFGL Aug. 1976 62 p refs

(Contract F19628-76-C-0010; OSURF Proj. 4214-A1)

(AD-A031331; DGS-242; AFGL-TR-76-0189; SR-4) Avail: NTIS HC A04/MF A01 CSCL 08/5

The accuracy of an airborne accelerometer-gradiometer system is studied for geodetic applications. A detailed analysis of interpolation, downward continuation and mean value determination is given using the method of least-squares collocation. The influence of measuring errors is considered and the contribution of accurate satellite altimetry to a combined accelerometer-gradiometer system is taken into account. The results of this study show that a system of this kind can significantly contribute to our knowledge of the anomalous gravity field if second-order gravitational gradients can be measured with an accuracy of a few Eotvos. Author (GRA)

N77-23652# Stanford Research Inst., Menlo Park, Calif.
THREE-DIMENSIONAL SEISMIC MODELING Final Report, 1 Nov. 1975 - 31 Jul. 1976
David C. Erlich Hanscom AFB, Mass. AFGL Aug. 1976 36 p refs
(Contract F19628-76-C-0064; AF Proj. 7639;
SRI Proj. PYU-4719)
(AD-A032314; AFGL-TR-76-0215) Avail: NTIS HC A03/MF A01 CSCL 08/11

The development of three-dimensional seismic modeling techniques has reached the state where such experiments can now be performed on a size scale convenient for the laboratory. A very homogeneous and isotropic syntactic foam was chosen as the seismic modeling material and a very sensitive surface motion transducer based on RF capacitive techniques was developed. This transducer is capable of measuring surface displacements as small as 1 microinch. (0.0254 micrometer) with rise times as fast as 1 microsecond and should be useful in many other applications. As a first test of the entire seismic modeling system, a 2 x 2 x 1 ft foam block was instrumented with three surface motion transducers, two strain gages, and three ytterbium foil stress gages and the block was loaded by detonation of our small, spherical explosive source. Peak surface displacements of about 10 micrometers and peak surface lateral strains of about 0.0001, both with better than 1% precision were recorded. The stress gage recorded peak stresses of about 5 bars, but lacked good precision in this very low stress region. Preliminary studies were made of producing a low-amplitude (on the order of 100 bar) plane wave loading over a wide area for future seismic modeling experiments. The use of a low-energy explosive mixture of PETN powder and hollow plastic spheres, separated from the surface to be loaded by an orifice plate, shows good promise. Author (GRA)

N77-23653# Naval Postgraduate School, Monterey, Calif.
THE POLAR PROBLEM IN A GLOBAL PREDICTION MODEL Technical Report, Jan. - Oct. 1976
R. T. Williams Nov. 1976 32 p refs
(AD-A033230; NPS-63WU76111) Avail: NTIS HC A03/MF A01 CSCL 04/2

This report investigates the behavior of the model when the initial flow is over the pole. The numerical solution eventually becomes unstable with this initial state. The difficulty is controlled by modifying the v field on the latitude circle which is closest to the pole. GRA

N77-23654# Army Electronics Command, Fort Monmouth N. J.
THE DEPTH OF THE SURFACE BOUNDARY LAYER
F. V. Hansen Jun. 1976 18 p refs
(DA Proj. 1T1-62111-AH-71)
(AD-A032408; ECOM-5596) Avail: NTIS HC A02/MF A01 CSCL 04/1

The depth of the surface boundary layer of the atmosphere can be related to a characteristic dimension defined by Obukhov as the scaling length L. By using the form of the diabatic wind and temperature profiles, the depth of the surface layer is demonstrated to be proportional to and a function of the slope of the wind profile and the Obukhov length. The methodology was verified using experimental data extracted from the literature. Generally, the surface boundary layer depth approaches the depth of the planetary boundary layer in near adiabatic conditions near sunrise and sunset. GRA

N77-23655# Air Force Geophysics Lab., Hanscom AFB, Mass.
RISE OF VOLCANIC ERUPTION CLOUDS: RELATIONSHIP BETWEEN CLOUD HEIGHT AND ERUPTION INTENSITY
Mark Settle 22 Jun. 1976 36 p refs
(AD-A033676; AFGL-TR-76-0127; AFGL-ERP-566) Avail: NTIS HC A03/MF A01 CSCL 04/1

The rise of eruption clouds is produced by the upward momentum and thermal buoyancy of volcanic dust and gas, processes which play important roles in other phenomena. The expansion of a turbulent jet in free flow is controlled by the rate at which the forward momentum of the jet is dissipated. Thermal buoyancy of industrial waste gases provides a mechanism for moving such wastes upward through the atmosphere and ensuring their dispersal over a wide area. The rise of volcanic eruption clouds can be modelled after these 2 analogous phenomena. In this report average ejection velocities at a volcanic vent ranging from 20 m/sec to 200 m/sec are assumed to represent a wide range of eruption intensity, from Strombolian to Vulcanian types. For eruption velocities varying from 20 m/sec to 200 m/sec, cloud heights estimated by the turbulent jet model range from 1,500 m to 6,500 m (mid-latitude eruption) while cloud heights estimated by the industrial plume models range from 900 m to 10,000 m. These estimates are considered to be roughly comparable in view of the assumptions and extrapolations involved in applying these models to explosive eruption conditions and agree quite well with reported heights of eruption clouds. The fact that comparable estimates of cloud height are produced by 2 very different models suggests that both momentum and thermal buoyancy play an important role throughout the main portion of an eruption cloud's trajectory. GRA

N77-23656# Visidyne, Inc., Burlington, Mass.
ANALYSIS OF HIGH ALTITUDE EFFECTS SIMULATION (HAES) Technical Report, 16 Apr. 1974 - 15 Apr. 1975
W. P. Reidy, T. C. Degges, and W. Neal Hanscom AFB, Mass. AFGL 1 Feb. 1976 81 p refs Sponsored in part by DNA
(Contract F19628-74-C-0177)
(AD-A033654; VI-311; SR-1; AFGL-TR-76-0039;
DNA-HAES-40) Avail: NTIS HC A05/MF A01 CSCL 04/1

Initial formulation of the analysis of the energy deposition and the electron density profiles in an EXCEDE-type experiment are presented. Altitude profiles are given for the night time zenith spectral radiance for CO2 bands at 4.3 micrometers and 15 micrometers and for the ozone band at 9.6 micrometers. Model calculations of the vibrational population of the first excited level of the CO2 nu sub 3 vibrational mode are also presented. GRA

N77-23657# Naval Research Lab., Washington, D. C.
PARAMETERIZATION OF THE ATMOSPHERIC HEATING RATE FROM 15 TO 120 km DUE TO O2 AND O3 ABSORPTION OF SOLAR RADIATION
Darrell F. Strobel Nov. 1976 42 p refs
(AD-A033854; NRL-MR-3398) Avail: NTIS HC A03/MF A01 CSCL 04/1

The atmospheric heating rate due to oxygen and ozone absorption of solar radiation is parameterized with an accuracy of + or - 5 percent in the altitude region 15-20 km. For relevant wavelengths the effects of multiple scattering and ground reflection are also included. These parameterizations are computationally fast, efficient, and suitable for use in numerical models of atmospheric circulation. Author (GRA)

N77-23658# M&S Computing, Inc., Huntsville, Ala.
PAR AURORAL STUDY, VOLUME 1 Interim Report
M. J. Mitchell 15 Mar. 1976 236 p 6 Vol.
(Contract DASG60-74-C-0026)
(AD-A034648; Rept-76-0013-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 04/1

The report describes the data collected in connection with research of aurora borealis effects on the performance of a phased array radar. The primary objective of the study was to advance the understanding of the auroral phenomenon and of its interactions with radar. A multi-megawatt phased array radar was used to collect large quantities of high resolution auroral backscatter data with simultaneous tracking of a number of selected satellites. The report provides a detailed description of the data collection process and data reduction techniques in connection with Sep 75 auroral storms. Author (GRA)

N77-23659# M&S Computing, Inc., Huntsville, Ala.
PAR AURORAL STUDY. VOLUME 2: A TECHNIQUE FOR STANDARDIZING THE PROCESSING OF AURORAL RADAR BACKSCATTER DATA Interim Report
M. J. Mitchell 19 May 1976 28 p refs 6 Vol.
(Contract DASG60-74-C-0026)
(AD-A034503; Rept-76-0016-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 04/1

The topic of radar reflectivity of aurora effects is discussed. The report describes a method for representing the volume backscattering characteristics of auroral irregularities. The objective

was to develop a universal relationship for calculating the aurora reflectivity. The expression would then normalize all radar-dependent parameters, including geographic location. In attempting to derive a classical solution to the problem, some ambiguous terms remain. However, the technique should prove useful for making certain limited comparisons of data from different radars. GRA

N77-23660# M&S Computing, Inc., Huntsville, Ala.
PAR AURORAL STUDY. VOLUME 3: A PRELIMINARY ANALYSIS OF THE DATA COLLECTED IN THE SPRING OF 1976 Interim Report
M. J. Mitchell, P. L. Alley, J. L. Brown, and M. Cochran 6 Aug. 1976 124 p refs 6 Vol.
(Contract DASG60-74-C-0026)
(AD-A034581; Rept-76-0027-Vol-3) Avail: NTIS HC A06/MF A01 CSCL 04/1

The report describes the data collected in connection with research of aurora borealis effects on the performance of a phased array radar. The primary objective of the study was to advance the understanding of the auroral phenomenon and of its interactions with radar. A multi-megawatt phased array radar was used to collect large quantities of high resolution auroral backscatter data with simultaneous tracking of a number of selected satellites. The report provides a detailed description of the data collection process and data reduction techniques in connection with Mar 76 auroral storms. These auroral storms may have been the most intense ever recorded by a radar. The sequence of forms was very dynamic and most unusual.
Author (GRA)

N77-23661# M&S Computing, Inc., Huntsville, Ala.
PAR AURORAL STUDY. VOLUME 4: IONOSPHERIC SCINTILLATION OF SATELLITE TRACKS DURING AURORA Interim Report
M. J. Mitchell and J. L. Brown 1 Sep. 1976 182 p refs
(Contract DASG60-74-C-0026)
(AD-A034504; Rept-76-0042-Vol-4) Avail: NTIS HC A09/MF A01 CSCL 04/1

The report describes data collected in connection with research of aurora borealis effects on the performance of phased array radar. In particular, the effects and deviations of ionospheric scintillations are discussed. GRA

N77-23662# M&S Computing, Inc., Huntsville, Ala.
PAR AURORAL STUDY. VOLUME 5: RADAR AURORAL MAGNETIC ASPECT SENSITIVITY MEASUREMENTS FROM THE PERIMETER ACQUISITION RADAR Interim Report
M. J. Mitchell and J. L. Brown 19 Oct. 1976 111 p refs 6 Vol.
(Contract DASG60-74-C-0026)
(AD-A034505; Rept-76-0052-Vol-5) Avail: NTIS HC A06/MF A01 CSCL 04/1

The report describes the measurements of the relationship of the apparent radar auroral reflectivity to the magnetic aspect angle. Also discussed is an evaluation of the effects of auroral clutter on the sidelobe blanker and measurement of effects of active auroral noise generation on the radar noise level. GRA

N77-23663# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
ARCHING OF MODEL ICE FLOES: EFFECT OF MIXTURE VARIATION ON TWO BLOCK SIZES
Darryl J. Calkins and George D. Ashton Nov. 1976 18 p refs
(AD-A033841; CRREL-76-42) Avail: NTIS HC A02/MF A01 CSCL 08/12

A study of arching of mixed, square fragmented ice floes at an opening in an ice boom is documented, using results from a model study in which two sizes of plastic blocks represented real ice. A power function, relating the upstream ice concentration to the ratio of a characteristic block dimension to the gap opening, is found adequate to distinguish between arching and nonarching events for block mixtures of two component sizes. It is demonstrated that when the respective total areas of the two block components are nearly equal, a minimum ice concentration initiates an arch across the opening. As the mixture of two sizes of blocks approaches a uniform (one-sized) mixture, a higher concentration of ice is needed to initiate the arch. When the ratio of the block dimension to the gap opening is equal to or less than 0.10, arching of the fragmented ice is not possible, even when the upstream ice discharge exceeds the maximum discharge of ice through a gap opening. The distribution of fragmented ice areas is an important parameter in establishing the minimum size of opening at which an ice boom will retain its arching capability. Author (GRA)

N77-23664# Defence Research Establishment Suffield, Ralston (Alberta).
COMPUTER SIMULATION OF ANOMALIES CREATED BY AN ARRAY OF FERROUS OBJECTS IN THE EARTH'S MAGNETIC FIELD
R. W. Hemrich Nov. 1976 26 p refs
(AD-A034036; DRES-Memo-29/76) Avail: NTIS HC A03/MF A01 CSCL 08/14

This report describes a FORTRAN IV computer simulation of a three-dimensional array of ferrous objects and its effect on the earth's magnetic field. The program output is a plot of the magnetic anomaly amplitude versus distance along a path similar to that recorded by a total field magnetometer passing over the array. The array size, object mass, direction of the earth's field and the altitude and direction of the path of the magnetometer are controlled by the user. One hundred and one computer words of storage are required for each pass. This study was done as part of a Range Clearance Technology task leading to the design of equipment for the detection of unexploded ordnance found on military ranges. Author (GRA)

N77-23665# Royal Norwegian Council for Scientific and Industrial Research, Kjeller.
THE NORWEGIAN SEISMIC ARRAY (NORSAR), PHASE 3 Final Report, 1 Jul. - 30 Sep. 1976
K.-A. Berteussen 27 Oct. 1976 72 p
(Contract F08606-76-C-0001; ARPA Order 2551)
(AD-A033848; NORSAR-SR-1-76/77) Avail: NTIS HC A04/MF A01 CSCL 08/11

This report covers research and operations activities at the Norwegian Seismic Array (NORSAR) for the period 1 July - 30 September 1976. This is the last period where the full (22 subarray) array configuration is retained. Within the reporting period there have been 170 breaks in the otherwise continuous operation of the Detection Processor (DP). The uptime percentage is 96.6. Three operators left in the period, and the vacant positions were covered by substitutes and overtime by the other operators. The bulletin production under the full-sized NORSAR has now been discontinued and some statistics for the period 1971-1976 are given. Altogether about 70,000 processings have been completed by the Event Processor (EP) out of which approximately 36,000 have been accepted as true events. In the DP a number of modifications have been performed in order to adapt the system to an environment with only 7 subarrays. At subarray 01B it has been technically checked out that in the new array configuration it will be possible to send attenuated long period (LP) data in parallel to the ordinary data flow. GRA

N77-23666# Texas Instruments, Inc., Dallas. Equipment Group.
APPLICATIONS OF HIGHER MODE SURFACE WAVES
Stephen S. Lane 8 Oct. 1976 30 p refs
(Contract F08606-76-C-0011; ARPA Order 2551)
(AD-A034883; TI-ALEX(01)-TR-76-10) Avail: NTIS HC A03/MF A01 CSCL 08/11

Amplitudes of first higher mode Love waves from seismic events in North America were measured on the North American continent and corrected for attenuation, structure, and distance. The corrected amplitudes were fitted to a source model to estimate the source depth. The high value of the attenuation coefficient and lack of a good seismic model prevented good agreement between known and calculated depths. In order to estimate the effect of the seismic source structure, the ratio of the first higher mode to fundamental Love wave amplitudes was found experimentally and compared to the theoretical prediction. Agreement was better than for the spectral fitting method but was still short of being satisfactory. Author (GRA)

N77-23667*# Stanford Univ., Calif. Inst. for Plasma Research.
ON THE CAUSES OF GEOMAGNETIC ACTIVITY
Leif Svalgaard 15 Dec. 1975 51 p refs
(Grant NGR-05-020-559; Contract N00014-76-C-0207; Grant NSF ATM-74-19007)
(NASA-CR-152690; AD-A021747; SU-IPR-646) Avail: NTIS HC A04/MF A01 CSCL 04/1

The causes of geomagnetic activity are studied both theoretically in terms of the reconnection model and empirically using the am-index and interplanetary solar wind parameters. It is found that two separate mechanisms supply energy to the magnetosphere. One mechanism depends critically on the magnitude and direction of the interplanetary magnetic field. Both depend strongly on solar wind speed. GRA

N77-23668# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
THE SENSITIVITY OF TROPICAL RADIATIVE BUDGETS TO CLOUD DISTRIBUTION AND THE RADIATIVE PROPERTIES OF CLOUDS M.S. Thesis
David OC. Starr Jun. 1976 132 p refs Sponsored in part by NOAA
(Grants NSF OCD-72-01681-A03; NSF OCD-74-21678)
(PB-263227/1; CSU-ATSP-254; ISSN-0067-0340) Avail: NTIS HC A07/MF A01 CSCL 04A

Broadband radiative transfer models are used to determine the sensitivity of radiative divergence and surface flux determinations in both the solar and infrared spectral intervals to inaccuracies in the descriptions of the temperature, moisture, aerosol, and cloud fields. Recommendations are made concerning the development of an objective cloud field determination scheme and the development of adequate methods of deducing the fields of radiative divergence. GRA

N77-23669# Emmanuel Coll., Boston, Mass.
STUDY AND ANALYSIS OF TOTAL ELECTRON CONTENT AND SCINTILLATION DATA Progress Report, 1 Jul. 1975 - 30 Jun. 1976
Santimay Basu, Charles J. Cantor, James Johanson, Eileen Mackenzie, and M. Patricia Hagan Oct. 1976 107 p refs
(Contract F19628-76-C-0003; AF Proj. 4643)
(AD-A034490; AFGL-TR-76-0260; Scientific-1) Avail: NTIS HC A06/MF A01 CSCL 20/14

This report embodies a study of Ionospheric Scintillations as considered from the following aspects: 1) Overall view of scintillations using a large data base, and also the detailed, individual magnetic storm picture. Solar flux level, seasonal variation, invariant latitude, and irregularity region are discussed. 2) Total Electron Content measurements through Faraday Rotation and Group Delay Methods. Results of employment of these techniques are discussed. The M-factor, for conversion of Faraday Rotation angles is studied, and associated use of it is displayed through a program for which documentation is included. 3) Characteristics of scintillations in the weak and strong scatter regimes. Results of the frequency dependence of scintillations, power spectra, and autocorrelation of amplitude fluctuations are discussed. 4) Daytime VHF scintillations. Type 1, type 2, and E sub sq irregularities are discussed. 5) A modification to the Signal Analysis Package, previously developed, is described. Application for use on the CDC 6600. Author (GRA)

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N77-23670 Cornell Univ., New York.
A WET-BULB CLIMATOLOGY OF THE UNITED STATES Ph.D. Thesis
Desmond Thomas Bailey 1976 213 p
Avail: Univ. Microfilms Order No. 77-5717

Two climatologies are developed to deal with the different types of problems encountered in the summer versus winter operation of evaporative cooling equipment. For the summer climatology, the contiguous United States is divided into four climatic regions based upon the mean coincidence of wet-bulb and dry-bulb temperatures during the month of July. The design wet-bulb temperatures used by the air conditioning industry are examined to determine their variability in time and space, and are related by regression analysis to other climatological variables. Synoptic and physical processes are examined to establish cause and effect relationships with the wet-bulb temperature, and are interpreted in terms of the climate types. The winter climatology is based on the mean coincidence of wet-bulb and dry-bulb temperatures for the month of January. These data are used to develop a map showing the geographical distribution of the potential for cooling tower fog. Dissert. Abstr.

N77-23671 Missouri Univ., Columbia.
SUBSYNOPTIC-SCALE KINETIC ENERGY ANALYSIS DURING THUNDERSTORM PERIODS Ph.D. Thesis
Ted Lee Tsui 1976 182 p
Avail: Univ. Microfilms Order No. 77-4964

The subsynoptic scale kinetic energy balance under thunderstorm conditions is investigated. The general shape of vertical profiles of kinetic energy generation and dissipation is very similar to that observed in well-developed major cyclones. For a given storm, not only does the magnitude of the kinetic energy parameter vary, but the balancing trend between kinetic energy generation and dissipation differs also. The strongest generation and dissipation are found in the upper troposphere (around 200 mb) of those storms having organized convective cells observed within the area. On the other hand, under conditions of little convective activity, the kinetic energy generation becomes a maximum kinetic energy destruction in the upper levels of the troposphere. During the storm period, the external source of kinetic energy plays an important role in the maintenance of the local circulation systems. The balance of eddy kinetic energy is also studied for the transient disturbances detected by the subsynoptic-scale network.
Dissert. Abstr.

N77-23672 Nevada Univ., Reno.
SURFACE EXCHANGE OF CLOUD CONDENSATION NUCLEI (CCN) Ph.D. Thesis
James Gary Hudson 1976 179 p
Avail: Univ. Microfilms Order No. 77-5986

Experiments were performed at four different locations in three distinct types of terrain. At all locations the concentrations were consistently greater at higher levels than at lower levels indicating surface deposition rather than surface production. During the day when the atmosphere was well mixed, the concentration differences were often less than 1 percent or sometimes effectively zero, though it was never measurably greater at the lower level. At night when the atmosphere tended to be stable, the differences in concentration were greater (up to 10 or 30 percent between 1 and 10 m) but the concentration was always less nearer the surface. The results of this work make the hypothesis that CCN are produced at or very near the continental surface quite unlikely. It would appear more likely that CCN are produced throughout the mixing layer and are in fact deposited at the surface.
Dissert. Abstr.

N77-23673 Nevada Univ., Reno.
DRIZZLE AS A MECHANISM FOR CLOUD BASE LOWERING Ph.D. Thesis
John Leonard Bowen 1976 108 p
Avail: Univ. Microfilms Order No. 77-5987

The influence of drizzle on the cloud base lowering of stratus clouds at the top of the marine layer off the coast of California was investigated. Drizzle falling into the moist layer beneath the clouds adds water vapor and removes heat by evaporation causing the layer to approach saturation. Mixing of this layer by turbulent diffusion results in a lowered condensation level or cloud base altitude. Dissert. Abstr.

N77-23674 Missouri Univ., Columbia.
HYBRID SIMULATION IN NUMERICAL WEATHER MODELING Ph.D. Thesis
Stephen Cho-yiu Sun 1976 224 p
Avail: Univ. Microfilms Order No. 77-4961

A hybrid simulation technique designed to implement a given weather model to prove the feasibility of applying modern

computational techniques to the problem of numerical weather prediction is presented. A specific hybrid system is described in detail, including analog hardware, simulation algorithm and control software. Experiments are performed and documented for system evaluation to study the effects of time-slicing, dc-drift, model size in atmospheric representation, and computer word length. The results are analyzed and compared with the theoretical results. Suggestions are made which should improve the system; that is, creating a larger, more realistic weather model in the hybrid weather simulation. Dissert. Abstr.

N77-23675 Deutscher Wetterdienst, Offenbach am Main (West Germany).
REPORTS FROM THE GERMAN METEOROLOGICAL SERVICE. VOLUME 18, NO. 139: MONTHLY PRECIPITATION MAPS FOR THE ENTIRE GLOBE [BERICHTE DES DEUTSCHEN WETTERDIENSTES. BAND 18, NR. 139. MONATSKARTEN DES NIEDERSCHLAGS FUER DIE GANZE ERDE]
Lutz Jaeger 1976 51 p refs In GERMAN; ENGLISH summary
(ISBN-3-88148-147-8) Avail: Issuing Activity

The maps were plotted with grid-points of precipitation values. The surface of the earth was divided into 2,592 five-degree fields in the center of which were situated the grid-points. For each grid-point monthly values of precipitation data were determined. On the continents this was realized by using climatic atlases with monthly maps, as far as possible from the registration period 1931 to 1960 on the oceans the annual map of Geiger was used. The monthly precipitation rates were determined with the help of percentage frequencies from the atlases of the U.S. Navy. On the basis of the monthly grid-point-values found, monthly maps of precipitation were plotted for the whole earth. The sum of the monthly values permitted the construction of a new annual map. In addition to this, balances were computed, as well as the monthly and in zonal relation for land and oceans for twelve big areas shaped on the surface of the earth. As far as possible the results were compared with those from earlier publications, for example with the isopleth-diagrams of Brooks/Hunt, the quarterly values of Moller or the American simulations of global precipitation on data processing machines. The precipitations in the tropical Pacific are looked at separately using an atlas made with island data by Taylor. The correlation of the monthly amounts of precipitation over South America and Africa are also examined with the length of the ITC. Author (ESA)

N77-23676 Deutscher Wetterdienst, Offenbach am Main (West Germany).
REPORTS FROM THE GERMAN METEOROLOGICAL SERVICE. VOLUME 18, NO. 140: THE EFFECTS OF TEMPERATURE AND RADIATION ON THE GROWTH OF YOUNG OAT PLANTS FOR CONSTANT WATER AND FERTILIZER SUPPLY [BERICHTE DES DEUTSCHEN WETTERDIENSTES. BAND 18, NR. 140: UNTERSUCHUNGEN ZUM EINFLUSS VON TEMPERATUR UND STRAHLUNG AUF DAS WACHSTUM JUNGER HAFERPFLANZEN BEI GLEICHBLEIBENDEM WASSER- UND DUENGERANGEBOT]
Ernst Franken 1976 27 p refs In GERMAN; ENGLISH summary
(ISBN-3-88148-148-6) Avail: Issuing Activity

A constant supply of water and nutrition is provided to the roots of young oat plants, growing on polystyrol plates. Every second day new seeds are layed out for germinating; thus, certain stages of weight are always available for daily weighing. The growth rates are evaluated for stands of the same weight in the morning, normally for periods of four days. These rates are entered into diagrams of temperature and radiation in order to draw isolines of growth rates, which demonstrate a clear dependence on these two meteorological factors. Author (ESA)

N77-23677 Deutscher Wetterdienst, Offenbach am Main (West Germany).
SPECIAL OBSERVATIONS OF THE METEOROLOGICAL OBSERVATORY HOHENPEISSENBERG NO. 33: RESULTS OF THE PLUVIOGRAPH NETWORK IN 1976 [SONDERBEOBACHTUNGEN DES METEOROLOGISCHEN OBSERVATORIUMS HOHENPEISSENBERG NO. 33: ERGEBNISSE DES REGENSCHREIBERSONDERNETZES IM JAHRE 1976]
1976 31 p In GERMAN
Avail: Issuing Activity

Rain recordings of stations in a special network are presented in addition to a frequency distribution of the hourly precipitation sum of some stations. The observation period is June to September 1976. ESA

N77-23678 Deutscher Wetterdienst, Offenbach am Main (West Germany).
SPECIAL OBSERVATIONS OF THE METEOROLOGICAL OBSERVATORY HOHENPEISSENBERG NO. 32: RESULTS OF AEROLOGICAL AND GROUND OZONE MEASUREMENTS DURING THE FIRST HALF OF 1976 [SONDERBEOBACHTUNGEN DES METEOROLOGISCHEN OBSERVATORIUMS HOHENPEISSENBERG NO. 32: ERGEBNISSE DER AEROLOGISCHEN UND BODENNAHEN OZONMESSUNGEN IM 1. HALBJAHR 1976]
1976 89 p In GERMAN
Avail: Issuing Activity

Aerological and ground ozone measurement results are presented in graphs and diagrams. ESA

N77-23679# National Severe Storms Lab., Norman, Okla.
OBJECTIVES AND ACCOMPLISHMENTS OF THE NSSL 1975 SPRING PROGRAM. PART 1: OBSERVATIONAL PROGRAM. PART 2: RADAR QUALITY CONTROL PROGRAM
K. Wilk, K. Gray, C. Clark, D. Sirmans, and J. Dooley Jul. 1976 122 p refs
(PB-263813/8; NOAA-TM-ERL-NSSL-78; NOAA-77010617)
Avail: NTIS HC A06/MF A01 CSCL 04B

The severe storm observational program in 1975 was reduced substantially from that of 1974. The program began with an intense 30-day quality control test, primarily concerned with the Doppler radars. The results are summarized. The routine severe storm surveillance program conducted between May 15 surveillance program conducted between May 15 and June 15 is summarized. Results of calibration procedures developed and tested in 1975 for the NSSL Doppler radars are described. These techniques are part of the daily routine in preparing for severe storm surveillance. The material is provided as an aid to users in selection of data sets and in evaluation of meteorological inferences. It is intended as a tabulation of descriptive parameters, subjective evaluations and listing of known problems associated with the data listed in the Data Summary Log. GRA

N77-23680# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH: EIGHTH STATUS REPORT ON IMPLEMENTATION
1976 145 p refs
(WMO-447; ISBN-92-63-10447-6) Avail: NTIS HC A07/MF A01; WMO, Geneva

The operational status of the World Weather Watch (WWW) plan is reported for each particular field and improvements expected in the coming years are dealt with. The elements of the WWW are the global observing system, the global data processing system, and the global telecommunication system. Use of the WWW facilities for operational hydrology is described. ESA

N77-23681# World Meteorological Organization, Geneva (Switzerland).
THE CIMO INTERNATIONAL EVAPORIMETER COMPARISONS Final Report
1976 42 p refs
(WMO-449; ISBN-92-63-10449-2) Avail: NTIS HC A03/MF A01; WMO, Geneva, Sw. Fr. 10

Results are presented of trials in different countries at selecting the most suitable type of evaporation pan to be used for estimating evaporation from a shallow lake. The performance of the two most used pans (the class A and the GCI 3000) is assessed with respect to both the 20 sq m tank and a Penman-type equation. ESA

N77-23682# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH: USE OF WWW FACILITIES FOR HYDROLOGY
1976 41 p refs
(WMO-451; WWW-PLR-35; ISBN-92-63-10451-4) Avail: NTIS HC A03/MF A01; WMO, Geneva

As one of its primary purposes, the World Weather Watch (WWW) supports the operational hydrology program. The possibilities of using the WWW facilities for hydrological purposes is analyzed. The scientific and technical programs of the WMO are outlined, and a brief description of the WWW is given. Various hydrological activities requiring real-time and non-real-time WWW support are critically examined in the light of availability of WWW facilities. In this connection, the roles of the global observing system, the global data-processing system and the global telecommunication system are examined. The procedural and administrative aspects concerning the presentation by hydrological services of their requirements for WWW facilities are described.
Author (ESA)

N77-23683# Physics Lab. RVO-TNO, The Hague (Netherlands).
THEORY AND MEASUREMENTS OF THE EFFECT OF RAINFALL ON INFRARED TRANSMISSION
J. B. VanDeVrie Mar. 1976 17 p refs
(Contract A72/KM/121)
(PhL-1976-07; TDCK-67547) Avail: NTIS HC A02/MF A01

Transmission in the 3.5 to 4.0 micron and 8.2 to 13.8 micron ranges was measured over a 6 km path at low height above sea surface. The effect of rainfall on the transmission was in particular analyzed. A computer model, based on size and terminal velocity distributions of raindrops, correlated with the rate of precipitation, was designed to calculate these transmissions as a function of path length and rate of rainfall. A good agreement was found between the results of the model and the measured values.
Author (ESA)

N77-23684# Panametrics, Inc., Waltham, Mass.
DEVELOPMENT OF FLIGHT ALUMINUM OXIDE WATER VAPOR SENSOR SYSTEMS Final Report, 1 May 1975 - 31 Aug. 1976
Philip Goodman 22 Oct. 1976 32 p refs
(Contract N00014-75-C-1114)
(AD-A031862) Avail: NTIS HC A03/MF A01 CSCL 04/2

Stratospheric humidity profiles were obtained with heated Al2O3 type water vapor sensors whose temperature during flight was maintained constant. Additional profiles were obtained with newer, integrated circuit type Aquamax TM sensors. The 'heated' sensor provided frost point data which generally increased with stratospheric altitude, in agreement with most earlier unheated sensor data. It is concluded that this type of humidity profile cannot result from ambient temperature effects upon the sensor. Heated sensor flight requirements resulted in excessively rapid descent rates and are thus incompatible with conventional radiosonde deployment. Aquamax sensors, which exhibit at least an order of magnitude more rapid response time in laboratory test systems, were flown unheated and data were corrected for ambient temperature. Some resultant profile data obtained during a much slower descent were almost identical with the 'heated' sensor data, providing additional evidence that the Al2O3 type sensor has an adequately rapid response time for balloon flights. Other Aquamax sensor profile data indicated a constant mixing ratio stratosphere which is unusual but has been observed earlier for Al2O3 sensor data. Data indicate that stratospheric profiles are variable and may be related to stratospheric circulatory patterns. Aquamax sensors, when developed in a heated version, should provide a means for convenient deployment with conventional radiosondes.
GRA

N77-23685# Naval Postgraduate School, Monterey, Calif.
A FINITE ELEMENT PREDICTION MODEL WITH VARIABLE ELEMENT SIZES M.S. Thesis
Richard Gordon Kelley, Jr. Sep. 1976 104 p refs
(AD-A031876) Avail: NTIS HC A06/MF A01 CSCL 04/2

There are a variety of meteorological forecast problems which require high spatial resolution in only a limited area. An important example of this type of problem is the prediction of tropical cyclones. This study tests a simple finite element prediction model with a variable element size. The shallow water equations are used and the motion is confined in a periodic channel on a f-plane. The Galerkin technique is applied to linear basis functions on triangular elements. The model uses leapfrog time differencing and periodic restarts. The model is tested with a wave imbedded in a mean flow and also with an isolated vortex. The experiments with a uniform element size show excellent phase propagation, but some small scale noise is generated. The introduction of momentum diffusion terms helps to control the noise. The model is also tested with elements which decrease abruptly in scale along a line and with elements which decrease smoothly. Both of these cases generate more noise than with uniform elements.
GRA

N77-23686# Naval Postgraduate School, Monterey, Calif.
FGGE AND ITS POTENTIAL BENEFITS TO THE NAVY Technical Report, Apr. - Sep. 1976
R. T. Williams Sep. 1976 29 p refs
(AD-A032344; NPS-63WU76091) Avail: NTIS HC A03/MF A01 CSCL 04/2

The objectives and historical background for the First GARP (Global Atmospheric Research Program) Global Experiment (FGGE) are presented. The required observational systems and the proposed data processing for the experiment are reviewed. The potential benefits to the Navy of a successful FGGE are discussed.
GRA

N77-23687# Air Force Geophysics Lab., Hanscom AFB, Mass.
EXPERIMENTAL STUDIES OF THUNDERSTORM ELECTRIFICATION Final Report
Donald R. Fitzgerald 22 Jun. 1976 41 p refs
(AD-A032374; AFGL-TR-76-0128; AFGL-ERP-567) Avail: NTIS HC A03/MF A01 CSCL 04/2

Airborne electric field sensing and computing systems have been developed and flown on C-130, F-100F, RF4C, and U-2 aircraft for studies of shower, cloud, and thunderstorm charge centers. Examples are given of the proper separation of field components and aircraft charge during thunderstorm penetrations and during direct lightning strikes to the test aircraft. Techniques have been employed for roll compensation of the aircraft-fixed field components so that real-time vector displays indicating the centroid of near-by charge concentrations are available for use in avoidance of probable lightning areas, or for use in selecting them to maximize the probability of a strike to test aircraft during lightning-aircraft interaction studies. The development of the storm electrical structure is directly related to details of the cloud water and ice distribution linked through the thermal and draft structure in the storm. Major features of the internal electrical pattern are often seen in data taken above, alongside, or at the surface. However, in accordance with electrostatic field theory, many of the fine structural details found within the storm are suppressed outside. The major vertical component field pattern is found to be one that could be produced by simple tilted dipolar charge structures. Depending on the physical conditions in different regions of the storm, the upper excess charge of the dipole may be either positive as generally reported from surface observations of the field, or it may be negative, as found in a number of the U-2 storm overflights accomplished in this project.
Author (GRA)

N77-23688# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
SNOW/CLOUD DISCRIMINATION Final Report
Francis R. Valovcin 4 Aug. 1976 17 p refs
(AF Proj. 6698)
(AD-A032385; AFGL-TR-76-0174; AFGL-AFSG-349) Avail: NTIS HC A02/MF A01 CSCL 04/2

The main objective of this investigation was to evaluate the usefulness of the data from the S192 Multispectral Scanner aboard Skylab in snow-cloud discrimination. From the available S192 screening films and digital tape data, the reflectance characteristics of snow, ice, and water clouds in different spectral bands from the visible into the near infrared spectral region can be determined. In the visible part of the spectrum, snow, ice, and water clouds appear white. In the near infrared, Band 11 (1.55 to 1.75 micrometers), water clouds are white, ice clouds are gray and snow is black. The ratio of the radiance values in Band 6 (0.68 to 0.76 micrometers) to Band 11 (1.55

to 1.75 micrometers) appears to provide a method for discriminating between snow cover, ice, and water clouds. Author (GRA)

N77-23689# Environmental Data Service, Washington, D. C. Center for Experiment Design and Data Analysis.
GATE CONVECTION SUBPROGRAM DATA CENTER: ANALYSIS OF SHIP SURFACE METEOROLOGICAL DATA OBTAINED DURING GATE INTERCOMPARISON PERIODS
Fredric A. Godshall, Ward R. Seguin, and Paul Sabol Nov. 1976 80 p refs
(PB-263000/2; NOAA-TR-EDS-17; NOAA-76121707) Avail: NTIS HC A05/MF A01 CSCL 04B

Ship surface meteorological data have been analyzed. Two types of data were collected: type 1, consisting of continuous and automatically recorded observations, and type 2, the manually recorded observations. Differences and the standard deviations of these differences between selected reference data sets and all other individual data sets have been computed. These results clearly depict the nature and magnitude of biases in pressure, dry-bulb temperature, wet-bulb temperature, sea surface temperature, and wind speed and direction. In addition, the report summarizes the instruments that were used on each ship and the location and height of each sensor. GRA

N77-23690# Office of Telecommunications, Boulder, Colo. Inst. of Telecommunication Sciences.
EVALUATION OF THE GOES DATA-BUOY INTERROGATION LINK
Donald V. Glen, Hiroshi Akima, and Earl C. Bolton Sep. 1976 70 p refs Sponsored in part by NOAA Data Buoy Office, Bay St. Louis, Miss.
(PB-261872/6; OTR-76-106) Avail: NTIS HC A04/MF A01 CSCL 04B

Bit error rate tests and radio set interrogations were made from the Command and Data Acquisition Station, Wallops Island, Virginia, to Boulder, Colorado, via the SMS-2 to measure performance. It was determined that (1) the received signal level was too low for reliable operation of the data collection buoy radio set using a low-gain omni-directional data buoy antenna and (2) the interrogation channel is subject to severe interference from non-government land mobile transmitters which have primary frequency allocation at 468.825 MHz. Improved performance was demonstrated through the use of a higher-gain antenna and the insertion of a low-noise amplifier in separate tests. GRA

N77-23691# National Weather Service, Fort Worth, Tex.
USEFUL RELATIONSHIPS BETWEEN 500 MB FEATURES AND MAJOR FREEZE EVENTS IN THE LOWER RIO GRANDE VALLEY OF TEXAS
Marshall V. McFarland (Texas A and M Univ., College Station) Oct. 1976 53 p refs
(PB-262932/7; NOAA-TM-NWS-SR-88; NOAA-76121006) Avail: NTIS HC A04/MF A01 CSCL 04B

The recognition guidelines for 500 mb patterns which may indicate a freeze are: short wave omega block super-imposed on a long wave ridge through central Alaska with a deep low system between Hudson Bay and Greenland; an east-west trough line over southern Canada or the northern United States with zonal flow and a strong jet to the south and northerly flow to the north of the trough line; a closed low moving southward through the Prairie Provinces of Canada developing into a long wave trough, with cyclogenesis; discontinuous retrogression of a full-latitude trough over the western United States involving a closed low or major east-west short wave moving southward without cyclogenesis; and a sharp full-latitude trough, frequently with a closed low, over the southeastern states. GRA

N77-23692# Maryland Univ., College Park. Computer Science Center.
CLOUD PATTERN CLASSIFICATION FROM VISIBLE AND INFRARED DATA
JoAnn Parikh Feb. 1976 171 p
(Contract F44620-72-C-0062)
(AD-A033037; AFOSR-76-1137TR; TR-442) Avail: NTIS HC A08/MF A01 CSCL 04/2

This report describes progress in the development of the area classification portion of a computer vision system for cloud pattern analysis. The ultimate goal of the vision system is to extract meteorologically significant cloud regions from a time sequence of dual-channel geosynchronous satellite images. The question explored by this paper is to what extent single-stage and multistage statistical pattern recognition techniques may be employed in the classification of clouds from a single dual-channel image. Author (GRA)

N77-23693# Office of Naval Research, London (England).
HIGHLIGHTS OF DYNAMICAL CLIMATOLOGY IN EUROPE
Albert I. Barcilon 12 Nov. 1976 13 p
(AD-A033335; NRL-R-9-76) Avail: NTIS HC A02/MF A01 CSCL 04/2

This report is divided into two main parts. The first deals very briefly with the broad questions raised by the modeling of climatic changes and should provide the non-initiated in this field with some ideas of the problems involved. The second part of the report focuses on some of the work in dynamical climatology (i.e., the numerical or theoretical modeling of climate changes) as is presently found in Europe. The survey does not pretend to be exhaustive and has been limited to modeling in which the time scale considered is monthly, seasonal or yearly. GRA

N77-23694# Naval Postgraduate School, Monterey, Calif.
A FINITE ELEMENT PREDICTION MODEL WITH VARIABLE ELEMENT SIZES Technical Report, Jan. - Sep. 1976
R. G. Kelley, Jr. and R. T. Williams Oct. 1976 110 p refs
(AD-A033229; NPS-63WU76101) Avail: NTIS HC A06/MF A01 CSCL 04/2

There are a variety of meteorological forecast problems which require high spatial resolution in only a limited area. An important example of this type of problem is the prediction of tropical cyclones. This study tests a simple finite element prediction model with a variable element size. The shallow water equations are used and the motion is confined in a periodic channel on a f-plane. The Galerkin technique is applied to linear basis functions on triangular elements. The model uses leapfrog time differencing and periodic restarts. The model is tested with a wave imbedded in a mean flow and also with an isolated vortex. The experiments with a uniform element size show excellent phase propagation, but some small scale noise is generated. The introduction of momentum diffusion terms helps to control the noise. The model is also tested with elements which decrease abruptly in scale along a line with elements which decrease smoothly. Both of these cases generate more noise than with uniform elements. Author (GRA)

N77-23695# Air Force Geophysics Lab., Hanscom AFB, Mass.
AREAL COVERAGE ESTIMATES BY STOCHASTIC MODELLING
Irving I. Gringorten 6 Jul. 1976 56 p refs
(AF Proj. 8624)
(AD-A031299; AFGL-TR-76-0148; AFGL-ERP-573) Avail: NTIS HC A04/MF A01 CSCL 04/2

The purpose of this paper is to relate the single-point probability of a meteorological event to the probability of its occurrence along a line or in an area of given size or fraction of the area. To make the problem tractable it was limited to modelling the probability estimates of the minimum or maximum condition along a line or in an area, or of the maximized minimum in a fraction of the area. In the absence of an analytical solution a Monte Carlo technique, applied to a Gaussian variable, was used to obtain answers that are presented graphically. Two models are described, one shown to be effective with macroscale events; the other, and more interesting model, is shown to be effective with the mesoscale phenomena of quantitative precipitation in areas ranging from a few hundred square kilometers to more than 50,000 sq. km. Author (GRA)

N77-23696# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
AN AUTOMATED SYSTEM FOR COLLECTING, PROCESSING, AND DISPLAYING ENVIRONMENTAL BASELINE DATA Final Report
Harold W. West and Herman M. Floyd Nov. 1976 99 p refs
(AD-A033359; WES-TR-M-76-11) Avail: NTIS

HC A05/MF A01 CSCL 14/2

A system for automated collecting, processing, and displaying of environmental baseline data is described. The functions of the system, consisting of data collection with an automated field station, data processing, and data display options, are discussed. Also included are descriptions of the environmental sensors that are being used with the field station. Data that were obtained with the system at 15-, 30, and 60-min sampling intervals over a period of several months at Pine Bluff Arsenal, Arkansas, Fort Carson, Colorado, Fort McClellan, Alabama, Upper Blakely Island near Mobile, Alabama, and Satartia, Mississippi, are analyzed. Example environmental data are presented in computer formats available with the system. An estimated cost (1976) of the automated field station and selected array of sensors is provided. Author (GRA)

N77-23697# Air Force Geophysics Lab., Hanscom AFB, Mass.
CLOUD DISTRIBUTIONS AS INDICATORS OF TROPICAL STORM DISPLACEMENT
Thomas J. Keegan 3 Aug. 1976 33 p refs
(AF Proj. 6698)
(AD-A033677; AFGL-TR-76-0170; AFGL-ERP-575) Avail: NTIS HC A03/MF A01 CSCL 04/2

This is a preliminary report on use of satellite cloud imagery to forecast tropical cyclone movements. The spatial distribution of cloudiness implicitly indicates information about recent or ongoing processes in the atmosphere. Assuming that as with cloud distribution represents a set of initial conditions, it is reasonable to expect that forecast information can be extracted from these initial conditions. The problem with using satellite imagery as a self-contained forecast tool has been the difficulty in handling the data processing. The Man-computer Interactive Data Access System (McIDAS) is a flexible data management system the advantages of both human decision-making computer. With McIDAS it is relatively simple to assemble composites of images of storms with similar displacement characteristics. These composites reinforce the cloud or cloudless features common to the individual cases and mute randomly distributed clouds. Investigation of typhoon cloudiness in the Pacific indicate that there are different characteristic cloud distributions preceding storms that recurve and those that stay on westerly tracks. In particular there is a confluence of outflow cloudiness from the storm with the clouds of a mid-latitude frontal system in the case of low-latitude westward moving storms in the Philippine and South China Seas. Characteristic cloud patterns associated with other types of storm systems are also suggested by the analysis. GRA

N77-23698# Regis Coll., Weston, Mass.
VISIBILITY MEASUREMENTS FOR PROBABILITY FORECASTS: MCIDAS SYSTEM CONFIGURATION AND CAPABILITIES RADIATIVE CHANGE OF SURFACE AIR TEMPERATURE Final Report, 20 Sep. 1974 - 30 Sep. 1976
Joan M. Ward, Mary R. Hermann, Leonarda Burke, Harold J. Pratt, and Roy M. Glasser Hanscom AFB, Mass. AFGL 30 Sep. 1976 60 p refs
(Contract F19628-75-C-0074)
(AD-A034046; AFGL-TR-76-0250) Avail: NTIS HC A04/MF A01 CSCL 04/2

Section 1: A pilot study was carried out to assess effects of time averaging of raw measurements on short-time predictability, as part of a development program directed toward automation of short-term forecasts and of airfield observations. Section 2: The capabilities of the general basic McIDAS system are studied with the purpose of adapting it to AFGL usage. Section 3: Six tables of pertinent statistical parameters present results of a study of numerical schemes for radiactive change in surface air temperature. Author (GRA)

N77-23699# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
PYRGEOMETER DATA REDUCTION AND CALIBRATION PROCEDURES
Bruce A. Albrecht and S. K. Cox May 1976 63 p refs Sponsored in part by NOAA and Eppley Labs., Inc., Newport, R. I.
(Grant NSF OCD-74-21678)
(PB-263029/1; CSU-ATSP-251; ISSN-0067-0340) Avail: NTIS HC A04/MF A01 CSCL 04B

The actual performance of an Eppley pyrgeometer is compared to the desired theoretical performance. Several systematic errors are identified and evaluated in detail. The most significant errors identified are due to battery voltage uncertainties, non-linearity of circuitry at extreme temperature, and differential heating of the instrument. The elimination of the error due to differential heating is found to be essential to the successful calibration of the instrument. A pyrgeometer laboratory calibration technique is described. GRA

N77-23700# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
COMPARISON BETWEEN THE MEASURED AND CALCULATED SPECTRAL CHARACTERISTICS OF SHORTWAVE RADIATION IN THE FREE ATMOSPHERE OVER THE DESERT (FROM THE DATA OF THE CAENEX-70 EXPEDITIONS) Research Report, Nov. 1975 - Nov. 1976
K. Ya. Kondratyev (Leningrad State Univ.), R. M. Welch, O. B. Vasilev (Leningrad State Univ.), V. F. Zhvalev (Main Geophys. Observ., Leningrad), L. S. Ivlev (Leningrad State Univ.), and V. F. Rodionov (Leningrad State Univ.) Dec. 1976 92 p refs Submitted for publication
(Grants NSF ATM-76-21348; NSF ATM-76-06178)
(PB-263049/9; AS-Paper-261; ISSN-0067-0340) Avail: NTIS HC A05/MF A01 CSCL 04B

Radiative transfer calculations have been performed in order to provide an independent check on the accuracy of previous measurements as well as provide recommendations for improved observations. The effect of a small amount of highly absorbing material, such as hematite, upon the radiation field has been demonstrated. Theoretical results indicate (1) that the effects of variations of the solar zenith angle during observations is not an important consideration, (2) that variations of surface albedo do not contribute significantly to the radiation fields in highly turbid conditions, (3) that ozone absorption variations are not important in the troposphere, and (4) that variations in the size distribution with height were surprisingly ineffective in determining radiation fluxes. GRA

N77-23701# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
THE STRUCTURE AND ENERGETICS OF THE TROPICAL CYCLONE
William M. Frank Oct. 1976 190 p refs
(Grants NOAA-04-3-158-51; NOAA-04-6-022-44021; NSF ATM-75-01424-A01)
(PB-263152/1; CSU-ATSP-258; ISSN-0067-0340) Avail: NTIS HC A09/MF A01 CSCL 04B

A simple cloud momentum flux parameterization is proposed. Substantial vertical mass recycling occurs in the middle and lower troposphere at all radii. Much of the convergence of mass and moisture is found to occur above the boundary layer suggesting that frictional convergence is not the sole forcing process of the radial circulation. Diurnal variations in temperature and precipitation are observed. Sea surface to air fluxes of sensible heat and moisture are smaller than those found in most previous studies. The mutual consistencies of the independent budget studies and the high accuracy of the uncorrected data support the usefulness of compositing as a valuable analysis technique. GRA

N77-23702# Colorado State Univ., Fort Collins. Dept. of Atmospheric Sciences.
TROPICAL DISTURBANCE INTENSIFICATION
Raymond Zehr Dec. 1976 99 p refs
(Grant NSF OCD-75-01424)
(PB-263153/9; CSU-ATSP-259; ISSN-0067-0340) Avail: NTIS HC A05/MF A01 CSCL 04B

An observational study of tropical cyclone genesis was made by compositing western Pacific rawinsonde data with respect to both pre-typhoon and non-developing cloud clusters. The size, intensity, and mean vertical motion of the disturbances which eventually evolved into typhoons were similar to the non-developing clusters which did not intensify. However, four primary physical differences between pretyphoon and non-developing clusters are found. GRA

N77-23703# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
DIURNAL VARIATION OF THE TROPOSPHERIC ENERGY BUDGET
Gary S. Foltz Nov. 1975 151 p refs
(Grant NSF OCD-75-01424)
(PB-263154/7; CSU-ATSP-262; ISSN-0067-0340) Avail: NTIS HC A08/MF A01 CSCL 04B

Diurnal radiative cooling values are computed for specific geographical regions and the magnitude of the required diurnal warming for each region is determined. A large morning maximum and late afternoon-early evening minimum of tropospheric required warning is found in all the data sets. This is hypothesized to result from enhanced morning subsidence produced by larger nocturnal radiational cooling. GRA

N77-23704# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
AN ANALYSIS OF THE GATE AIRCRAFT PYRGEOMETER INSTRUMENTATION
Bruce A. Albrecht, Stephren K. Cox, and M. Prokofyev (Main Geophys. Observ., Leningrad) Nov. 1976 36 p refs Submitted for publication Sponsored in part by NOAA
(Grants NSF OCD-72-01681; NSF OCD-74-21678)
(PB-263226/3; AS-Paper-255) Avail: NTIS HC A03/MF A01 CSCL 04B

Pyrgeometer measurements were compared with independent measurements obtained with an infrared bolometer and with a radiative transfer calculation. The differences noted during GATE and post-GATE intercomparisons may be attributed to differences in calibration techniques and the accurate determination of the temperature of the instrument's thermopile cold junctions. When corrections based upon this analysis were applied to the U.S.S.R. data, the maximum intercomparison differences were less than 5 percent. GRA

N77-23705# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
A FREQUENCY DISCRIMINATOR VS. FFT DOPPLER EXTRACTION
R. Jeffrey Keeler Dec. 1976 30 p
(PB-263815/3; NOAA-TM-ERL-WPL-17; NOAA-77010612) Avail: NTIS HC A02/MF A01 CSCL 04B

An attempt was made to point out some of the Quan-Tech's limitations relative to acoustic wind profiling. Using a FFT-derived power spectrum of received echoes was shown to give some reliable, i.e., higher SNR, estimates of Doppler profiles by virtue of its added frequency dimension. The operation of the frequency tracking loop was explained in sufficient detail to enable one unfamiliar with its operation to use its various operating configurations with at least some intelligence. Field experience was related and explanations given for underestimates of wind profiles during these exercises. Increased dynamic range and enhanced SNR are the most important advantages of using the FFT to derive Doppler profiles. A detailed study was undertaken to compare Quan-Tech discriminator (QTD) derived profiles with FFT derived profiles. Main results of the correlation studies and profile studies were shown in tables and figures. The FFT was shown to be superior. GRA

N77-23706# National Oceanic and Atmospheric Administration, Washington, D. C. Center for Experiment Design and Data Analysis.
GATE CONVECTION SUBPROGRAM DATA CENTER: SHIPBOARD PRECIPITATION DATA
Ward R. Seguin and Paul Sabol Nov. 1976 79 p refs
(PB-263820/3; NOAA-TR-EDS-18; NOAA-77010406) Avail: NTIS HC A05/MF A01 CSCL 04B

Precipitation amounts at the time resolution they were recorded on shipboard WMO marine logs during the 1974 GARP Atlantic Tropical Experiment (GATE) are presented. Tabulations include both daily amounts and precipitation totals for each of the three observation phases. Tables show rainfall amounts as reported by each ship. Recording frequency varied. Only the time periods for which there was a measurable amount of precipitation are included in the tables. All data were checked against weather observations as recorded in the WMO marine logs to ensure that there was agreement between prevailing weather conditions at the time of reported rainfall. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N77-23707 California Univ., San Diego.
OPTIMIZED SYSTEM FOR HIGH RESOLUTION MEASUREMENTS OF OCEANIC TEMPERATURE AND VELOCITY Ph.D. Thesis
Arne Croizat Mortensen 1976 183 p
Avail: Univ. Microfilms Order No. 77-4216

An experimental and theoretical study of vehicle dynamics and probe response has been conducted for a freely falling, self-rotating, wing stabilized vehicle which carries metallic oxide semiconductor velocity and temperature probes at the nose (most forward part in the direction of fall) and on one of four wings. A Lagrangian formulation of the vehicle dynamics is used to establish differential equations of motion which are solved numerically. Temperature data collected at sea has been analyzed to show that total variance is recoverable provided noise contamination is minimal. Resolution of temperature measurements depends on a trade-off between signal/noise ratio and spatial response, and this trade-off, which varies for different parts of the ocean depending on the strength of local gradients, is a function of flow rates at the probes, probe size, and power applied to the probes. Dissert. Abstr.

N77-23708 California Univ., San Diego.
THE FINE STRUCTURE OF VELOCITY AND TEMPERATURE MEASURED IN THE LABORATORY AND THE ATMOSPHERIC MARINE BOUNDARY LAYER Ph.D. Thesis
1976 222 p
Avail: Univ. Microfilms Order No. 77-4215

Measurements of velocity and temperature down to the Kolmogorov microscale were taken in the marine boundary layer between heights of 3 m and 30 m from the R/V FLIP. These measurements were used to test the theories of local isotropy and universal similarity as well as examining the structure of sheared turbulent scalar fields which display a persistent ramp-like time series signature. Although the velocity inertial subrange constant was found to be about 0.5 in agreement with previous measurements, the inertial subrange slope and universal constant for temperature was found to show a high degree of variability. Examination of the temperature variance budget led to the conclusion that two possible physical sources could cause this variability in the marine boundary layer. Dissert. Abstr.

N77-23709*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPUTER SOFTWARE SYSTEM FOR THE GENERATION OF GLOBAL OCEAN TIDES INCLUDING SELF-GRAVITATION AND CRUSTAL LOADING EFFECTS
Ronald H. Estes (Business and Technological Systems, Inc., Bowie, Md.) Apr. 1977 63 p refs Submitted for publication
(Contract NAS5-20045)
(NASA-TM-X-71308; X-920-77-82) Avail: NTIS HC A04/MF A01 CSCL 08C

A computer software system is described which computes global numerical solutions of the integro-differential Laplace tidal equations, including dissipation terms and ocean loading and self-gravitation effects, for arbitrary diurnal and semidiurnal tidal constituents. The integration algorithm features a successive approximation scheme for the integro-differential system, with time stepping forward differences in the time variable and central differences in spatial variables. Solutions for M2, S2, N2, K2, K1, O1, P1 tidal constituents neglecting the effects of ocean loading and self-gravitation and a converged M2, solution including ocean loading and self-gravitation effects are presented in the form of cotidal and corange maps. Author

N77-23710*# Business and Technological Systems, Inc., Seabrook, Md.
A COMPUTER SOFTWARE SYSTEM FOR THE GENERATION

OF GLOBAL OCEAN TIDES INCLUDING SELF-GRAVITATION AND CRUSTAL LOADING EFFECTS Final Report
R. H. Estes Feb. 1977 64 p refs
(Contract NAS5-20045)
(NASA-CR-152502; BTS-TR-77-41) Avail: NTIS HC A04/MF A01 CSCL 08C

A computer software system is described which computes global numerical solutions of the integro-differential Laplace tidal equations, including dissipation terms and ocean loading and self-gravitation effects, for arbitrary diurnal and semidiurnal tidal constituents. The itegration algorithm features a successive approximation scheme for the integro-differential system, with time stepping forward differences in the time variable and central differences in spatial variables. Author

N77-23711# Woods Hole Oceanographic Institution, Mass.
ACCURACY OF TEMPERATURE MEASUREMENTS WITH THE VACM
Richard E. Payne, Alvin L. Bradshaw, Jerome P. Dean, and Karl E. Schleicher Oct. 1976 85 p refs
(Contract N00014-76-C-0197; NR Proj. 083-400)
(AD-A032003; WHOI-76-94) Avail: NTIS HC A05/MF A01 CSCL 08/10

The report describes temperature measurement techniques with the Vector Averaging Current Meter (VACM) designed at WHOI and manufactured at AMF. Included are descriptions of circuitry, calibration techniques and calibration results. Precision calibrations of VACM thermistors began in 1971 at WHOI. Of the thermistors in our pool, 70 have had at least 3 calibrations over a period no shorter than 2 years. Of these 70 thermistors the results described show that 51 are stable. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N77-23712*# Kanner (Leo) Associates, Redwood City, Calif.
KOSMOS-782 POST-FLIGHT BIOCHEMICAL STUDIES OF VARIOUS ORGANS AND TISSUES OF RATS
R. A. Tigranyan Washington NASA Oct. 1976 33 p refs Transl. into ENGLISH of "Biokhim. Issled. Razlichnykh Organov i Zaversheniya Kosmich. Poleta na Biosputnike 'Kosmos-782'", Acad. of Sci. USSR, Moscow, Oct. 1975 26 p
(Contract NASw-2790)
(NASA-TT-F-17237) Avail: NTIS HC A03/MF A01 CSCL 06C

The Kosmos-782 biological studies used three groups of male SPF Wistar rats: one on the bio-sputnik; one housed in a vivarium and fed flight rations; and one simultaneous experimental group with flight conditions exactly reproduced except for weightlessness. The following tissues and organs were studied: blood, skeletal muscles, myocardium, brain, bony tissue, digestive system, lymphoid organs, and liver. The flight lasted 20 days. Examination of tissues and organs was made 6 to 10 hours post-flight and 26 days after completion of the experiments. Author

N77-23713*# Aeronutronic Ford Corp., Houston, Tex. Aero-Comm Engineering Service Div.
SCREWWORM ERADICATION DATA SYSTEM (SEDS) PREPROCESSOR PROGRAM DOCUMENTATION, PART 1
7 Apr. 1976 129 p ref
(Contract NAS9-1261)
(NASA-CR-147864; JSC-10019-Pt-1) Avail: NTIS HC A07/MF A01 CSCL 06C

To achieve the capability required by the Screwworm Eradication Data System (SEDS) and to process the 14-track analog tapes supplied by the National Oceanic and Atmospheric Administration, the existing Earth Resources Preprocessor Software Subsystem (ERPSS) was enhanced. A brief overview of the ERPSS is given along with descriptions of only those computer program components that were modified to meet the SEDS requirements. Author

N77-23714*# Aeronutronic Ford Corp., Houston, Tex. Space Information Systems Operation.
SCREWWORM ERADICATION DATA SYSTEM (SEDS) APPLICATIONS PROGRAM DOCUMENTATION, PART 2
2 Jul. 1976 1132 p
(Contract NAS9-1261)
(NASA-CR-147865; JSC-10019-Pt-2) Avail: NTIS HC A99/MF A01 CSCL 06C

National Oceanic and Atmospheric Administration (NOAA) satellite data, which is in analog tape form, is converted into output data products. These products are used by investigators in determining optimum areas for airdrops of steril screwworm flies over Mexico. The output product of SEDS takes the form of imagery data film slides showing Mexico and the lower southwest portion of the United States. The area analog preprocessing phase of the SEDS task is covered. Author

N77-23715*# Aeronutronic Ford Corp., Houston, Tex. Engineering Services Div.
SCREWWORM ERADICATION DATA SYSTEM (SEDS) OPERATIONAL MANUAL, PART 3
6 Jul. 1976 258 p ref
(Contract NAS9-1261)
(NASA-CR-147866; JSC-10019-Pt-3) Avail: NTIS HC A12/MF A01 CSCL 06C

All phases of SEDS operation as well as utility routines, error messages, and system disk maintenance procedures are described. Display layouts and examples of runs are included as additional explanation to SEDS program procedures. Author

N77-23716# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
INFLUENCE OF PIRACETAM ON PROTEIN SYNTHESIS AND ENERGY METABOLISM IN THE RAT BRAIN [DE INVLOED VAN PIRACETAM OP EIWITSYNTHESE EN ENERGIEHUISHOUDING IN DE HERSENEN VAN DE RAT]
Victor J. Nickolson and Otto L. Wolthuis Mar. 1976 27 p refs Partly in ENGLISH and partly in DUTCH
(MBL-1976-3; TDCK-67524) Avail: NTIS HC A03/MF A01

The acquisition enhancement (learning improvement) of piracetam (2-pyrrolidon-N-acetamide) was studied. To this end the protein metabolism in the rat cerebral cortex was investigated and the rat cerebral energy metabolism studied. For individual titles, see N77-23717 through N77-23718.

N77-23717# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
PROTEIN METABOLISM IN THE RAT CEREBRAL CORTEX IN VIVO AND IN VITRO AS AFFECTED BY THE ACQUISITION ENHANCING DRUG PIRACETAM
Victor J. Nickolson and Otto L. Wolthuis *In its* Influence of Piracetam on Protein Syn. and Energy Metab. in the Rat Brain Mar. 1976 p 1-12 refs Sponsored by Found. of Med. Res. FUNGO (For primary document see N77-23716 14-51)
Avail: NTIS HC A03/MF A01

The effect of piracetam (2-pyrrolidon-N-acetamide) on rat cerebral protein metabolism in vivo and in vitro was studied. It was found that the drug stimulates the uptake of labeled leucine by cerebral cortex slices, has no effect on the incorporation of leucine into cerebral protein, either in slices or in vivo, but inhibits the breakdown of newly formed protein in slices. Author (ESA)

N77-23718 Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
EFFECT OF THE ACQUISITION ENHANCING DRUG PIRACETAM ON RAT CEREBRAL ENERGY METABOLISM. COMPARISON WITH NAFTIDROFURYL AND METHAMPHETAMINE
Victor J. Nickolson and Otto L. Wolthuis *In its* Influence of Piracetam on Protein Syn. and Energy Metab. in the Rat Brain Mar. 1976 p 13-25 refs Sponsored by Found. of Med. Res. FUNGO (For primary document see N77-23716 14-51)
Avail: NTIS HC A03/MF A01

The effects of piracetam (2-pyrrolidon-N-acetamide), naftidrofuryl, oxalate of N-diethylaminoethylester of beta-(1-naphtyl)-beta'-(2-tetrahydrofuryl)isobutyric acid, and methamphetamine on several parameters of cerebral energy metabolism were studied.

Neither piracetam nor naftidrofuryl affected the cerebral contents of adenine nucleotides, and, accordingly, both substances were without effect on the adenylate energy charge. Methamphetamine also had no effect on cerebral adenine nucleotides. Piracetam increased the activity of adenylate kinase (EC.2.7.4.3) in isotonically diluted rat brain homogenates without altering the K sub M of the enzyme for ADP as substrate. It is concluded that although piracetam has no effect on the cerebral energy metabolism under normal conditions, it may have a beneficial effect under marginal conditions such as those met during hypoxia, by virtue of its adenylate kinase stimulating action. It is suggested that this action is responsible for the protective effect of piracetam against cerebral hypoxia. It may also be related to the enhancement of acquisition under training conditions where cerebral energy metabolism is disturbed. Author (ESA)

N77-23719# Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry.

ACTION OF RADIATIONS ON SOME BIOLOGICAL MODEL SYSTEMS Technical Progress Report, 1 Oct. 1975 - 1 Jun. 1976

G. Stein 1976 14 p

(Contract E(11-1)-3009)

(COO-3009-25) Avail: NTIS HC A02/MF A01

The topics investigated include: investigation of the action of ionizing radiation on enzyme proteins, using the technique of pulse radiolysis; the use of fast nanosecond laser pulse techniques in the study of biochemical and biological model systems; and the action of ionizing radiation on mammalian cells, particularly at low doses. Using chromatin as the model substance, radiation biological processes at the nucleoprotein level were investigated. ERA

N77-23720# Aerojet Liquid Rocket Co., Sacramento, Calif.

STORABILITY INVESTIGATIONS OF WATER, LONGTERM STORAGE EVALUATION Annual Report, 1 Oct. 1975 - 30 Sep. 1976

E. M. VanderWall and G. R. Janser Dec. 1976 65 p refs

(Contract F04611-72-C-0062)

(AD-A034796; AFRPL-TR-76-95; AR-3) Avail: NTIS HC A04/MF A01 CSCL 13/2

The objective of this program is to gather data that will permit the Air Force to assess the long term storage characteristics of water, particularly with regard to formation of particulate matter, so that the feasibility of long-term storage of water for use as a transpiration coolant can be determined. Five metallic materials of construction are included in the program: 304 stainless steel, A-286 (aged) steel, 17-4 (aged) stainless steel, Inconel 718 (aged), 6Al-4V titanium (STA). Two types of water are used in the program: oxygen-saturated, deionized, filtered, and oxygen-free, deionized, filtered. Five-year storage tests have been initiated in 304 and 17-4pH stainless steels, A-286 steel, Inconel 718, and 6Al-4V titanium (STA) containers using the filtered, deionized waters. Evaluation of water and containers stored for thirty months and thirty-six months has been completed. The data show that both oxygen-saturated and oxygen-free water can be stored in appropriate metal containers for the selected time periods without detrimental particulate matter formation or significant changes in the quality of the water. It is in excellent condition for transpiration coolant purposes. Author (GRA)

N77-23721# Joint Publications Research Service, Arlington, Va.

SPACE BIOLOGY AND AEROSPACE MEDICINE, NO. 2, 1977

O. G. Gazenko, ed. 4 May 1977 132 p refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 90 p

(JPRS-69045) Avail: NTIS HC A07/MF A01

The following articles are considered: the selection and training of cosmonauts; evaluation and analysis of accumulated data to facilitate the on-going transition from orbital to interplanetary flight; research aimed at guaranteeing safety on long flights and reliability of the human component of the man spaceship system; space psychology and physiology; environmental problems and control; and telemetry. For individual titles, see N77-23722 through N77-23740.

N77-23722# Joint Publications Research Service, Arlington, Va.

CURRENT STATUS OF SPACE BIORHYTHMOLOGY c52

B. S. Alyakrinskiy *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 1-14 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 3-12 (For primary document see N77-23721 14-51)

Avail: NTIS HC A07/MF A01

The hazard of disruption of circadian rhythms in view of orbital flights was examined in the light of data in general biorhythmology obtained from studies of the effects on man of changing latitudes, working on evening and night shifts, and in the Arctic region. All of the studies demonstrated impairment of the initial state of the body, varying in degrees: sleep disorders, poor appetite and affect, impaired function of the gastrointestinal tract, neurotic symptoms, and occasionally organic disease.

Author

N77-23723# Joint Publications Research Service, Arlington, Va.

BIOMEDICAL RESEARCH ON THE PROBLEM OF ARTIFICIAL GRAVITY c52

A. R. Kotovskaya, R. R. Galle, and A. A. Shipov *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 15-24 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 12-19 (For primary document see N77-23721 14-51)

Avail: NTIS HC A07/MF A01

The effects on the human body of prolonged (up to one month) stays in a rotating system were investigated. It was established that it is possible, in principle, for man to exist in an object that rotates at a constant angular velocity. Efficiency is retained and there are no health endangering disturbances.

Author

N77-23724# Joint Publications Research Service, Arlington, Va.

RESULTS OF CLINICAL EXAMINATION OF COSMONAUTS FOLLOWING A 63-DAY FLIGHT c52

A. V. Beregovkin, T. N. Krupina, G. D. Syrykh, M. M. Korotayev, N. A. Kuklin, V. A. Balandin, V. S. Znamenskiy, V. I. Nikiforov, V. V. Nistratov, and V. D. Portnov *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 25-28 Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 19-22 (For primary document see N77-23721 14-51)

Avail: NTIS HC A07/MF A01

In two Soviet cosmonauts, the preflight bioelectrical activity of the myocardium showed no appreciable deviations from normal; both cosmonauts presented only isolated extrasystoles, which were recorded during some studies at rest and during the load tests. In flight, the rhythm of cardiac contractions was constantly sinusoid, with moderate sinus arrhythmia. During the period of putting the spacecraft in orbit, as well as during flight, some extrasystoles were recorded; their appearance was usually preceded by emotional or physical tension. Author

N77-23725# Joint Publications Research Service, Arlington, Va.

ELECTROGRAPHIC EXAMINATION OF THE CREW ON THE SECOND EXPEDITION OF SALYUT-4 c52

M. M. Korotayev, I. I. Popov, V. A. Degtyarev, Z. Z. Borofeyeva, A. D. Yegorov, V. V. Kalinichenko, S. I. Ponomarev, V. P. Sidorov, A. P. Polyakova, Z. A. Golubchikova et al *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 29-33 Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 22-26 (For primary document see N77-23721 14-51)

Avail: NTIS HC A07/MF A01

Cosmonauts' EKG's were analyzed during and after a prolonged orbital flight, using both DS leads and the classical leads used in clinical practice. The EKG was recorded both at rest and while the cosmonauts performed functional tests on a bicycle ergometer with loads of 350 to 450 kg-m/min lasting 5 min. Polinom equipment was used to record the EKG; it permitted synchronous recording of 3 EKG leads, calibration of the signal, transmission of data over telemetry channels and recording on the onboard magnetic tape storage devices. Author

N77-23726# Joint Publications Research Service, Arlington, Va.

CHANGES IN HEMODYNAMICS AND PHASIC STRUCTURE OF THE CARDIAC CYCLE IN THE CREW ON THE SECOND EXPEDITION OF SALYUT-4 **c52**

V. G. Doroshev, T. V. Batenchuk-Tusko, N. A. Lapshina, Yu. A. Kukushkin, N. D. Kalmykova, and V. N. Ragozin *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 34-39 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 26-31 (For primary document see N77-23721 14-51)

Avail: NTIS HC A07/MF A01

In preparing for the flight of the Salyut-4 orbital research station, a bicycle ergometer was installed on board for the purpose of functional tests with a physical load. The test involving a physical load was conducted using an analogue of the onboard bicycle ergometer in the preflight and postflight periods. During the flight on the Salyut-4, the crew members did not experience any subjective discomfort. The exercise performed by the cosmonauts constituted 2,100 to 2,200 kg-m/m in 5 minutes at the pedaling rate of 56 to 60 r/minute. The results of this study confirmed the fact that, in weightlessness, the reaction of the circulatory system remains at about the preflight level. Author

N77-23727# Joint Publications Research Service, Arlington, Va.

DYNAMICS OF VENOUS CIRCULATION IN COSMONAUTS ON THE SECOND EXPEDITION OF SALYUT-4 **c52**

Ye. M. Yuganov, V. A. Degtyarev, A. S. Nekhayev, T. V. Batenchuk-Tusko, Ye. A. Kobzev, V. S. Bednenko, and S. V. Ivanova *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 40-48 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 31-37 (For primary document see N77-23721 14-51)

Avail: NTIS HC A07/MF A01

Venous circulation was investigated in the crew of the Salyut-4 orbital research station, obtained on the basis of analysis of graphic tracings of jugular vein pulsation. The dynamics of form of pulsograms and venous blood pressure were observed. The duration of phases of the right heart was measured. Author

N77-23728# Joint Publications Research Service, Arlington, Va.

EVALUATION OF PULSE RATE DYNAMICS IN MEMBERS OF THE SECOND CREW OF SALYUT-4 AT REST AND DURING INFLIGHT PERFORMANCE OF FUNCTIONAL TESTS **c52**

O. G. Itsekhovskiy, A. P. Polyakova, and V. R. Lyamin *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 49-54 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 37-42 (For primary document see N77-23721 14-51)

Avail: NTIS HC A07/MF A01

The pulse rate response of cosmonauts during the Salyut-4 flight, both at rest and during functional tests with LBNP (lower body negative pressure) and physical exercise on a bicycle ergometer, was studied. American specialists conducted analogous studies during the flight of the Skylab orbital station. Author

N77-23729# Joint Publications Research Service, Arlington, Va.

PREDICTION AND ANALYSIS OF COSMONAUTS' PULSE RATE BY THE METHOD OF EXTRAPOLATION MODELING IN THE CLASS OF DIFFERENTIAL EQUATIONS **c52**

V. K. Vasilyev, A. A. Guyev, A. B. Savvin, and Yu. M. Svirezhev *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 55-62 ref Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 42-47 (For primary document see N77-23721 14-51)

Avail: NTIS HC A07/MF A01

Use of the method of extrapolation modeling in the class of differential equations was quite acceptable to solve tasks dealing with prediction of dynamics of physiological indices of cosmonauts in the course of prolonged flights. The forecast error was close to the errors made by medical experts. With increase in forecast time from 1 to 3 days, there was negligible change in error. This confirms the fact that the selected model in the form of equation describes the dynamics of pulse rate rather well. For comparison purposes, along with the model, algebraic polynomials to the power of 4.7 were used to predict the pulse rate of cosmonauts. In this instance, there was significant increase in errors with increase in number of days for which the forecast was made. Author

N77-23730# Joint Publications Research Service, Arlington, Va.

RESULTS OF METABOLIC STUDIES ON THE CREW OF THE SECOND EXPEDITION OF THE SALYUT-4 ORBITAL STATION **c52**

R. A. Tigranyan, I. A. Popova, M. I. Belyakova, N. F. Kalita, Ye. G. Tuzova, L. B. Sochilina, and N. A. Davydova *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 63-70 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 48-53 (For primary document see N77-23721 14-51)

Avail: NTIS HC A07/MF A01

The biochemical studies conducted according to the program of the second expedition of the Salyut-4 orbital station were directed toward extensive investigation of metabolism of the principal systems in the organism of a man who was exposed for a long time to the complex set of space flight factors, as well as changes observed at the early stages of readaptation to earth's gravity. Author

N77-23731# Joint Publications Research Service, Arlington, Va.

EFFECTS OF 22-DAY SPACE FLIGHT ON LYMPHATIC ORGANS OF RATS

G. N. Durnova, A. S. Kaplanskiy, and V. V. Portugalov *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 71-75 refs Transl. into ENGLISH from Rosm. Biol. Aviakosm. Med. (Moscow), 1977 p 53-57 (For primary document see N77-23721 14-51)

HC A07/MF A01

The effects of space factors, and first of all of weightlessness, on the system of lymphatic organs with hemopoietic and immunocompetent functions were investigated. The spleen, thymus, and inguinal lymph nodes of 14 rats were studied that had spent 22 days onboard the artifical earth satellite, Kosmos-605 and were sacrificed 2 and 27 days after this flight, and 12 rats from a ground-based model experiment, in which all of the space flight conditions, with the exception of weightlessness, were simulated, also sacrificed at the same times. The lymphatic organs of 23 rats kept in a vivarium for the duration of the experiment served as a control. Author

N77-23732# Joint Publications Research Service, Arlington, Va.

INTESTINAL AUTOFLORA OF TEST SUBJECTS IN THE COURSE OF A 6-MONTH BIOENGINEERING EXPERIMENT **c52**

M. S. Rerberg, N. S. Manukovskiy, and L. A. Somoya *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 76-79 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 57-59 (For primary document see N77-23721 14-51)

Avail: NTIS HC A07/MF A01

The intestinal microflora of four subjects who stayed in a BIOS-3 closed system of life support for a long time was studied. The effects of conditions in the BIOS-3 system on the intestinal microflora of man was determined. The studies were continued for 6 months. Subject T. remained in the BIOS-3 system for the entire 6 months, P., for the first 3 months, B. for the last 4 months, and Sh. for the first 2 and last 2 months. They were all on a mixed diet. Part of the food was delivered from the outside in lyophilized form, and the rest (bread, vegetables) was provided as a result of recycling of matter in the system. Author

N77-23733# Joint Publications Research Service, Arlington, Va.

RHEOGRAPHIC STUDY OF THE HUMAN CARDIOVASCULAR SYSTEM WITH EXPOSURE TO HIGH PRESSURE FOR MANY DAYS **c52**

L. I. Ardashnikova and L. A. Chudnovskaya *In its* Space Biol.

and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 80-86 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 60-64 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

In the presence of elevated pressure and respiration of compressed air or nitrogen and oxygen mixtures, changes occured in various vascular regions and, first of all, in the pulmonary circulatory system due to the higher density of the gas environment. The rheographic index (RI) and index of blood delivery to the brain, as well as to the legs, differed little at rest under 5 atm(abs) pressure. However, there were rather significant fluctuations of the index on different days. After exercise, the increase in RI and pulsed delivery of blood to the brain was more marked under hyperbaric conditions in four out of the six subjects. There were significant individual fluctuations detected. S.M.

N77-23734# Joint Publications Research Service, Arlington, Va.

EVALUATION OF EFFECTIVENESS OF MUSCULAR ELECTROSTIMULATION FOR THE PREVENTION OF DISORDERS RELATED TO PROLONGED RESTRICTION OF MOTOR ACTIVITY IN MAN c52

M. A. Cherepakhin, L. I. Kakurin, Ye. I. Ilina-Kakuyeva, and G. T. Fedorenko *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 87-91 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 64-68 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

The efficacy of electrostimulation of muscles combined with physical exercise, as well as without exercise, was evaluated. Bed rest was the model of weightlessness. The Tonus-2 apparatus was used for electrostimulation. Two series of studies were pursued, each lasting 7 weeks. The subjects stayed in bed in an antiorthostatic position. Muscular atrophy is prevented by means of electrostimulation; however it does not prevent deconditioning of the cardiovascular system. Endurance training, combined with electrostimulation, elicited a distinct preventive effect. S.M.

N77-23735# Joint Publications Research Service, Arlington, Va.

EXPERIMENTAL EVALUATION OF RELATIONSHIP BETWEEN PULMONARY BLOOD FLOW, FLUID-ELECTROLYTEMETABOLISM AND ORTHOSTATIC REACTIONS OF MAN

I. D. Pestov, Kh. Kh. Asanov, B. F. Asyamolov, V. A. Karpusheva, I. I. Kasyan, V. S. Panchenko, and V. I. Stephantsov *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 92-98 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 68-74 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

The quantitative correlation between delivery of blood to the pulmonary circulation and regulation of fluid-electrolyte metabolism, which is the basis of the Henry-Gauer reflex, was confirmed and defined. Facts were obtained that were indicative of disproportionate correlations between changes in fluid metabolism and orthostatic stability. Author

N77-23736# Joint Publications Research Service, Arlington, Va.

SENSITIVITY OF HYPOKINETIC ANIMALS TO CENTRAL NERVOUS SYSTEM STIMULANTS

L. Ya. Kolemeyeva, V. S. Shashkov, and B. B. Yegorov *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 99-105 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 74-79 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

The effects of restricted motor activity (RMA) varying in duration on animal sensitivity to central nervous system (CNS) stimulants is investigated. Stimulants with a predominant effect on different parts of the CNS were selected. These agents were also used as pharmocological analyzers of impairment of physiological functions associated with RMA. Experiments were conducted on 1,150 white, mongrel male rats and using for CNS stimulants--caffeine, phenamine (amphetamine) and strychnine. Author

N77-23737# Joint Publications Research Service, Arlington, Va.

INVESTIGATION OF MECHANICAL ACTIVITY OF CANINE SKELETAL MUSCLES IN VIVO

V. G. Kozlova, V. S. Oganov, and A. S. Rakhmanov *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 106-110 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 79-83 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

Mechanical activity of different muscles of the dog, recorded by dynamomyography in different modes of locomotion was studied. Preliminary analysis of some quantitative correlations between strength characteristics of muscles and their electrical activity was examined. Author

N77-23738# Joint Publications Research Service, Arlington, Va.

A PORTABLE DEVICE FOR DETERMINING STATIC ENDURANCE OF RATS

A. A. Shipov and A. S. Markin *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 111-113 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 83-84 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

Determination of static endurance of over 500 male rats of different ages on the proposed device revealed that the maximum holding time is characterized by minor scatter and great stability in animals of the same weight. The advantages of this device (lack of physical stimuli, minor scatter of obtained data, simple construction, small weight, and portability) enable it to be used in studies related to changes in physical efficiency of animals under the influence of the most diverse factors. Author

N77-23739# Joint Publications Research Service, Arlington, Va.

DIFFUSION CAPACITY OF THE HUMAN LUNGS UNDER THE COMBINED EFFECT OF HYPOKINESIA c52

A. N. Kotov *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 114-117 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 85-86 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

The mechanisms of changes in DL of man in the presence of hypokinesia, as well as under the combined effect of hypokinesia and hypoxia, were demonstrated. There were two groups of males who were kept on strict bed rest for 49 days. DL was determined by the steady state method using the Diffusiotest--Godart instrument. The subject alternately inhaled a mixture of air and CO and oxygen and CO. Author

N77-23740# Joint Publications Research Service, Arlington, Va.

EFFECT OF DIOXANE ON FUNCTIONAL STATE OF THE RAT'S CENTRAL NERVOUS SYSTEM

G. I. Solomin *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 118-122 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 87-89 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

A toxicological study of dioxane-1,4 was made. The nature of the effect of this compound on functional state of the central nervous system, in concentrations that could be encountered under real conditions, was determined. On the basis of these tests, the threshold concentration was substantiated. These concentrations of dioxane were determined by degree of its toxicity and need to determine threshold and subliminal concentrations, with regard to biological effects, as well as levels thereof in the air of sealed chambers. Author

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N77-23741 California Univ., Berkeley.
QUESTIONS OF UNIQUENESS AND RESOLUTION IN RECONSTRUCTION OF 2-D AND 3-D OBJECTS FROM THEIR PROJECTIONS Ph.D. Thesis
Myron Bernard Katz 1976 162 p
Avail: Univ. Microfilms Order No. 77-4493

Questions of uniqueness and sensitivity to noise are resolved for reconstructions on a grid or raster, and are found to be critically related to the resolution attempted. Nonuniqueness can only occur if the attempted resolution is too fine; in that case, a complete description of all possible reconstructions is given. Sensitivity to noise is resolved by a method which permits a computation of the optimal projection angles which minimize the variance in the estimate of the reconstruction when noisy data are utilized. It is shown that the extent to which an object is determined by its projection data depends on how an approximation is defined i.e., the resolution of a reconstruction. It is shown that once physically justifiable assumptions are made, it is possible to predict how well a reconstruction approximates the original unknown function. The presented theory can also be applied to reconstruction on finite demensional spaces other than the space associated with a grid. Dissert. Abstr.

N77-23742 Connecticut Univ., Storrs.
A NON-EQUILIBRIUM THERMODYNAMIC THEORY OF MUSCLE TENSION DEVELOPMENT Ph.D. Thesis
Robert Walter Bass 1976 93 p
Avail: Univ. Microfilms Order No. 77-4248

A non-equilibrium thermodynamic analysis of the time varying concentration of Calcium ions in the myoplasm of striated muscle fiber is presented. Relationships are shown between the forces and fluxes of Calcium ions and the dissociation of ATP for the case of unstimulated muscle. It is shown that the phenomenon of electrical stimulation of muscle and the resultant time varying response can be obtained by examination of the phenomenological coefficients which describe the sarcoplasmic reticulum membrane porosity. Since muscle contraction is a direct consequence of the concentration of Calcium ions in the myoplasm, the analysis yields time varying muscle tension. Pertinent constants and initial values are evaluated from the data available in the literature. It is shown that the use of these numerical values yields a time varying tension for an isolated electrical stimulus similar to that observed experimentally. Furthermore, the theory yields the fused twitch and tetanic contraction observed experimentally when the electrical stimulation frequency is increased. Dissert. Abstr.

N77-23743*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INDUCTION POWERED BIOLOGICAL RADIOSONDE Patent Application
Thomas B. Fryer, inventor (to NASA) Filed 12 May 1977 26 p
(NASA-Case-ARC-11120-1; US-Patent-Appl-SN-796256) Avail: NTIS HC A03/MF A01 CSCL 06B

An induction powered implanted monitor was designed for epidurally measuring intracranial pressure and telemetering the pressure information to a remote readout. The monitor utilizes an L-C oscillator in which the C comprises a variable capacitance transducer, one electrode of which is a small stiff pressure responsive diaphragm. The oscillator is isolated from a transmitting tank circuit by a buffer circuit and all electric components in the implanted unit except an input and an output coil are shielded by a metal housing. NASA

N77-23744# Interuniversitair Reactor Instituut, Delft (Netherlands).
COMPARATIVE INVESTIGATION OF TRACE ELEMENTS IN HUMAN BLOOD [VERGELIJKEND ONDERZOEK VAN SPOORELEMENTEN IN MENSELIJK BLOED]
J. J. M. DeGoeij, P. S. Tjioe, C. Pries, and J. H. L. Zwiers 1976 47 p refs In DUTCH Prepared jointly with Central Lab. TNO
(IRI-133-76-10) Avail: NTIS HC A03/MF A01

Five different neutron activation analysis methods for the determination of trace elements in human blood were compared. In procedure 4 the samples are irradiated directly without chemical separation, and the induced radioactivity is measured with a Ge(Li) detector. This method was found to be excellent for the determination of bromine, potassium, sodium, rubidium, and iron. With procedures 1 and 5, certain quantities of the non-radioactive elements to be determined are added and, after destruction, the elements are separated by distillation and column chromatography. The radioactivity is measured with a NaI(Tl) scintillation crystal. This method is suitable for antimony, copper, mercury, selenium, iron , and zinc. For the determination of cobalt, molybdenum, and nickel the more sensitive methods 2 and 3 are used, which in combination with procedures 1 and 5 allow the quantitative determination, in 1 ml blood, of the 14 important trace elements, antimony, arsenic, bromine, cadmium, cobalt, gold, copper, mercury, molybdenum, nickel, rubidium, selenium, iron, and zinc. ESA

N77-23745# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.
THE DIAGNOSTICS OF BONE AND JOINT CHANGES DURING COMPRESSED AIR LABOR Ph.D. Thesis - Bonn Univ.
Gerhart Fuchs 26 Oct. 1976 77 p refs In GERMAN; ENGLISH summary
(DLR-FB-76-53) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 34.90

A detailed presentation of the pathogenesis, symptomology, and treatment of decompression sickness is given and the causes for secondary bone damages are described. The central problem is the extensive and exact recognition of the secondary bone damage. Various relevant publications are critically reviewed and possible consequences are discussed. Author (ESA)

N77-23746# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.
EXPERIMENTAL INVESTIGATIONS ON CHANGES OF THE BONE AND JOINT STRUCTURE IN ANIMALS AFTER EXPOSURE TO HYPOBARIC ENVIRONMENTS Ph.D. Thesis - Bonn Univ.
Thomas Gilfert 26 Oct. 1976 35 p refs In GERMAN; ENGLISH summary
(DLR-FB-76-54) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 18.50

Pathological effects of decompression in the hypobaric environment of man are described, and the histological changes of the bone and joint structure in animals after exposure to hyperbaric environment are reviewed. Experimental investigations on albino rats are presented in which the pathological changes of the bone structure as a consequence of the decompression in a hypobaric environment could be proven; they are shown by illustrations of the histological section of bone and joint material. Author (ESA)

N77-23747# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
DEFINITION STUDY FOR SPACELAB EXPERIMENTS IN THE FIELD OF MEDICAL FUNDAMENTALS AND RESEARCH TECHNIQUES Final Report
Erich Ull and Wolfgang Hepp Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1976 183 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-391)
(Contracts BMFT-WRT-1074; GfW-RV-21-V-55/74)
(BMFT-FB-W-76-15) Avail: NTIS HC A09/MF A01; ZLDI, Munich DM 38.45

Investigations on potential influences of Spacelab parameters on physiological and medical functions have revealed the possible use of Spacelab for medical tasks. A number of biomedical experiment proposals, defined during the course of the study in discussions with medical doctors, are presented. A first listing of instruments necessary to conduct the experiments in Spacelab is given and various activities to prepare Spacelab experiments are proposed. Author (ESA)

N77-23748# Rutgers Medical School, Piscataway, N. J.
MULTI-ELECTRODE TIME-MULTIPLEX TELEMETRY Final Report, 1 Oct. 1975 - 31 Oct. 1976
Sid Deutsch Jan. 1977 21 p refs
(Contract N00014-76-C-0241)
(AD-A034134) Avail: NTIS HC A02/MF A01 CSCL 06/2

Two multi-electrode time-multiplex telemetry units and their decoders are described: first, a 15-electrode totally-implanted unit that has a basic cycle rate of 400 Hz, and second, a 7-electrode partially-implanted unit that has a basic cycle rate of 4000 Hz. A remote 7-electrode stimulator-monitoring unit is briefly mentioned. Author (GRA)

N77-23749# School of Aerospace Medicine, Brooks AFB, Tex.
RETINAL THERMAL MODEL OF LASER-INDUCED EYE DAMAGE: COMPUTER OPERATOR'S MANUAL Final Report, Jun. 1975 - Jun. 1976
Alan R. Mertz, Bruce R. Anderson, Earl L. Bell, and David E. Egbert Nov. 1976 137 p refs
(AF Proj. 6301)
(AD-A034239; SAM-TR-76-33) Avail: NTIS HC A07/MF A01 CSCL 09/2

A user-oriented description is given of a computer program for predicting thermal eye damage caused by exposure to laser radiation. This report describes the parameters necessary to run the program and provides a suggested range of values for the parameters. The input and output are described in detail, as are many of the capabilities and limitations of the program. The parameters and required input steps for a plot routine used to plot the temperature rises within the ocular structures are also presented. The architecture of the program and the interpretation of the input and output can be found in the IIT Research Institute technical report, 'Thermal Model of Laser-Induced Eye Damage' (AD-A017201). Author (GRA)

N77-23722# Joint Publications Research Service, Arlington, Va.
CURRENT STATUS OF SPACE BIORHYTHMOLOGY
B. S. Alyakrinskiy *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 1-14 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 3-12 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

N77-23723# Joint Publications Research Service, Arlington, Va.
BIOMEDICAL RESEARCH ON THE PROBLEM OF ARTIFICIAL GRAVITY
A. R. Kotovskaya, R. R. Galle, and A. A. Shipov *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 15-24 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 12-19 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

N77-23724# Joint Publications Research Service, Arlington, Va.
RESULTS OF CLINICAL EXAMINATION OF COSMONAUTS FOLLOWING A 63-DAY FLIGHT
A. V. Beregovkin, T. N. Krupina, G. D. Syrykh, M. M. Korotayev, N. A. Kuklin, V. A. Balandin, V. S. Znamenskiy, V. I. Nikiforov, V. V. Nistratov, and V. D. Portnov *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 25-28 Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 19-22 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

N77-23725# Joint Publications Research Service, Arlington, Va.
ELECTROGRAPHIC EXAMINATION OF THE CREW ON THE SECOND EXPEDITION OF SALYUT-4
M. M. Korotayev, I. I. Popov, V. A. Degtyarev, Z. Z. Borofeyeva, A. D. Yegorov, V. V. Kalinichenko, S. I. Ponomarev, V. P. Sidorov, A. P. Polyakova, Z. A. Golubchikova et al *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 29-33 Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 22-26 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

N77-23726# Joint Publications Research Service, Arlington, Va.
CHANGES IN HEMODYNAMICS AND PHASIC STRUCTURE OF THE CARDIAC CYCLE IN THE CREW ON THE SECOND EXPEDITION OF SALYUT-4
V. G. Doroshev, T. V. Batenchuk-Tusko, N. A. Lapshina, Yu. A. Kukushkin, N. D. Kalmykova, and V. N. Ragozin *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 34-39 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 26-31 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

N77-23727# Joint Publications Research Service, Arlington, Va.
DYNAMICS OF VENOUS CIRCULATION IN COSMONAUTS ON THE SECOND EXPEDITION OF SALYUT-4
Ye. M. Yuganov, V. A. Degtyarev, A. S. Nekhayev, T. V. Batenchuk-Tusko, Ye. A. Kobzev, V. S. Bednenko, and S. V. Ivanova *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 40-48 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 31-37 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

N77-23728# Joint Publications Research Service, Arlington, Va.
EVALUATION OF PULSE RATE DYNAMICS IN MEMBERS OF THE SECOND CREW OF SALYUT-4 AT REST AND DURING INFLIGHT PERFORMANCE OF FUNCTIONAL TESTS
O. G. Itsekhovskiy, A. P. Polyakova, and V. R. Lyamin *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 49-54 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 37-42 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

N77-23729# Joint Publications Research Service, Arlington, Va.
PREDICTION AND ANALYSIS OF COSMONAUTS' PULSE RATE BY THE METHOD OF EXTRAPOLATION MODELING IN THE CLASS OF DIFFERENTIAL EQUATIONS Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 42-47
V. K. Vasilyev, A. A. Guyev, A. B. Savvin, and Yu. M. Svirezhev *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 55-62 ref (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

N77-23730# Joint Publications Research Service, Arlington, Va.
RESULTS OF METABOLIC STUDIES ON THE CREW OF THE SECOND EXPEDITION OF THE SALYUT-4 ORBITAL STATION
R. A. Tigranyan, I. A. Popova, M. I. Belyakova, N. F. Kalita, Ye. G. Tuzova, L. B. Sochilina, and N. A. Davydova *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 63-70 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 48-53 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

N77-23732# Joint Publications Research Service, Arlington, Va.
INTESTINAL AUTOFLORA OF TEST SUBJECTS IN THE COURSE OF A 6-MONTH BIOENGINEERING EXPERIMENT
M. S. Rerberg, N. S. Manukovskiy, and L. A. Somoya *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 76-79 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 57-59 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

N77-23733# Joint Publications Research Service, Arlington, Va.
RHEOGRAPHIC STUDY OF THE HUMAN CARDIOVASCULAR SYSTEM WITH EXPOSURE TO HIGH PRESSURE FOR MANY DAYS
L. I. Ardashnikova and L. A. Chudnovskaya *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 80-86 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 60-64 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

N77-23734# Joint Publications Research Service, Arlington, Va.
EVALUATION OF EFFECTIVENESS OF MUSCULAR ELECTROSTIMULATION FOR THE PREVENTION OF DISORDERS RELATED TO PROLONGED RESTRICTION OF MOTOR ACTIVITY IN MAN
M. A. Cherepakhin, L. I. Kakurin, Ye. I. Ilina-Kakuyeva, and G. T. Fedorenko *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 87-91 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 64-68 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

N77-23739# Joint Publications Research Service, Arlington, Va.
DIFFUSION CAPACITY OF THE HUMAN LUNGS UNDER THE COMBINED EFFECT OF HYPOKINESIA
A. N. Kotov *In its* Space Biol. and Aerospace Med., No. 2, 1977 (JPRS-69045) 4 May 1977 p 114-117 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), 1977 p 85-86 (For primary document see N77-23721 14-51)
Avail: NTIS HC A07/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N77-23750# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
PERFORMANCE DECREMENT DURING PROLONGED NIGHT DRIVING
J. B. J. Riemersma, A. F. Sanders, C. Wildervanck, and A. W. Gaillard Aug. 1976 24 p refs Presented at the NATO Symp. on Vigilance 2: Relationships among Theory, Physiol. Correlates and Operational Performance, St. Vincent, Italy, 3-6 Aug. 1976 (Contract A74/KL/003)
(IZF-1976-14; TDCK-68563) Avail: NTIS HC A02/MF A01

In an attempt to demonstrate progressive performance decrement, an exploratory experiment was carried out in which the effects of long-term work, declining diurnal rhythm, and accumulating sleep loss converge. Subjects carried out a continuous driving task between 22.00 h and 6.00 h, preceded and followed by two driving tests of 45 minutes each. In another condition they had only the pre- and post-test and slept in between. The results show progressive decrements of performance on several performance measures, including lane drifting and two subsidiary tasks. In general, considerable recovery was observed in the post-test. Although heart rate declined and heart rate variability increased during the long nightly spell, there are strong arguments against relating heart-rate and fatigue. Suggestions for future research are discussed. Author (ESA)

N77-23751# Columbia Univ., New York. Psychophysics Lab.
HUMAN PERFORMANCE CAPABILITIES Final Report, 1 Oct. 1971 - 31 Dec. 1975
Eugene Galanter 1 Oct. 1976 36 p refs
(Contract N00014-67-A-0108-0031; NR Proj. 197-016)
(AD-A031462) Avail: NTIS HC A03/MF A01 CSCL 05/10

This is the final report that reviews the research, both experimental and theoretical, conducted by the Psychophysics Laboratory, Columbia University. Three main sections discuss (1) the measurement of utility, (2) response organization, and (3) Psychophysical scaling. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N77-23752 Missouri Univ., Columbia.
SIMULATION OF CARBON DIOXIDE CONCENTRATOR Ph.D. Thesis
Omar El-Farouk Abdel-Salem 1976 211 p
Avail: Univ. Microfilms Order No. 77-4880

A mathematical model is developed to model and simulate the performance of an electrochemical carbon dioxide concentrator designed for use in manned spacecraft. The analysis of the kinetic and mass transport mechanisms reduces to the solution of two nonlinear ordinary differential equations which are solved by a shooting method. Most of the parameters required by the model are estimated from independent measurements or theoretical expressions. The model simulates the carbon dioxide removal rate over the experimental range and extends calculations well beyond the experimental range. It can be used in optimum design studies. The model also calculates the concentration distributions of the different species. These are important in determining the limits of cell operation in low humidity environments and can be useful in estimating the overvoltage components in the cell. Dissert. Abstr.

N77-23753*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
KINEMATIC CAPABILITY IN THE SVDS
H. Flanders Mar. 1977 51 p refs
(Contract NAS9-15200)
(NASA-CR-151360; LEC-10246; JSC-12606) Avail: NTIS HC A04/MF A01 CSCL 05H

The details of the Remote Manipulator System kinematic model implemented into the Space Vehicle Dynamics Simulation are given. Detailed engineering flow diagrams and definitions of terms are included. Author

N77-23754*# Stanford Research Inst., Menlo Park, Calif.
A TACTILE PAGING SYSTEM FOR DEAF-BLIND PEOPLE, PHASE 2
James A. Baer May 1977 28 p
(Contract NAS2-8711; SRI Proj. 3980)
(NASA-CR-151994) Avail: NTIS HC A03/MF A01 CSCL 05H

Control logic and the on-body radio transmitter is investigated. The control logic capability and studied methods for implementing the on-body portion of the logic in a small package are improved. A small low power, on-body transmitter was designed, developed, and tested with a wrist-strap antenna to extend the one-way communication system developed during Phase 1 to a two-way communication system. Author

N77-23755# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
A BRIEF EXPERIMENT TO COMPARE THE WEARING PROPERTIES OF TWO VERSIONS OF THE C3-MASK
W. A. Lotens 1976 6 p In DUTCH; ENGLISH summary
(Contract A76/KL/079)
(IZF-1976-13; TDCK-68564) Avail: NTIS HC A02/MF A01

The wearing properties of the Canadian General Tire C3 gasmask were investigated. Subjectively perceivable differences between two versions (old (O) and new (N)) of the C3 protective mask were tested in a small scale experiment in which eight subjects performed work like walking and ergometer cycling while wearing the masks. No significant differences were found in wearing properties of the masks. Neither did the skin temperature of the face differ very much (N only 0.1 C cooler than O). This, together with the impressions obtained, led to the conclusion that N will certainly not be worse than O. In fact, negligent

fitting of the mask will probably have more effect than the differences between the masks. Author (ESA)

N77-23756# Arizona State Univ., Tempe. Coll. of Education.
AN AUTOMATED MEASUREMENT TECHNIQUE FOR EVALUATING PILOT SKILL Interim Report
Brian D. Shipley Feb. 1976 135 p refs
(Grant AF-AFOSR-2900-76)
(AD-A033920; TN-60229; AFOSR-76-1253TR) Avail: NTIS HC A07/MF A01 CSCL 05/9

This dissertation seeks to discover specific indicators of performance skill in pilot training. An algorithmic, performance state evaluation model was developed for an instrument flight maneuver with performance times and deviations from a standard flight path as indicators of skill. The algorithm's initial procedures and these indicators were used in 3 empirical investigations. The first showed that performance times can be used to enable an observer to discriminate between performances or performance states in performances by two experienced pilots. In the second investigation, means of total performance time were found to discriminate between differences in treatments used in a training experiment with student pilots as subjects; and a priori predictions of differences in effects of these treatments on variability of group performances at a specified location were significant. In the final investigation, support was found for the hypothesis that a small set of specific indicators could be used to replace a summary indicator of variability in performances. Results of stepwise regression analyses indicated that 7 of 12 specific indicators could be used to account for 34 percent to 82 percent of the variance in the summary indicator over 6 performance trials. GRA

N77-23757# Human Engineering Labs., Aberdeen Proving Ground, Md.
AN AUDITORY-VISUAL INTERACTION MODEL FOR MONITORING ARMY MATERIEL/INFORMATION DISPLAYS Final Report
Lynn C. Oatman Dec. 1976 22 p refs
(AD-A033865; HEL-TM-37-76) Avail: NTIS HC A02/MF A01 CSCL 05/8

In many military operations such as in command or air-traffic-control centers, great quantities of information are displayed to the operators simultaneously. This paper discusses the process of selective attention. It reviews recent models of information processing, and suggests a model of auditory-visual interactions which describes the processes that might underlie selective attention. The model suggests that a central processor allocates capacity for processing important sensory messages in preference to others. The model suggests how the human operator can routinely operate in an environment where many signals compete for attention, where time available for dealing with each signal is limited and where the required precision of analysis changes continuously. GRA

N77-23758# Calspan Corp., Buffalo, N.Y.
PERFORMANCE EVALUATION OF THE NHTSA ADVANCED S SERIES 50TH PERCENTILE ANTHROPOMORPHIC DUMMY. VOLUME 2: ACCELERATOR SLED TEST DATA Final Report, Jun. 1975 - Jul. 1976
Daniel E. Massing and Phyllis E. Yates Nov. 1976 518 p 2 Vol.
(Contract DOT-HS-5-01260)
(PB-263650/4; CALSPAN-ZS-5778-V-2; DOT-HS-802094) Avail: NTIS HC A22/MF A01 CSCL 13F

The dynamic performance repeatability of the NHTSA 'S' Series dummy was evaluated in four different sled test configurations. Type-2 belt, preinflated air bag, energy absorbing steering column, and Type-1 belt with simulated instrument panel test environments were utilized to measure the performance of two identically fabricated dummies. In addition, a Part 572 dummy with Type-2 belts was tested to establish a control data set for the configuration. The graphical results of a statistical analysis performed on the results obtained from replicate tests of each configuration are presented. GRA

N77-23759# Maryland Univ., College Park. Dept. of Computer Science.
THE CAUSAL PRESENTATION AND SIMULATION OF PHYSICAL MECHANISMS
Chuck Rieger and Milt Grinberg Nov. 1976 137 p refs
(Contract N00014-76-C-0477)
(AD-A034194; TR-495) Avail: NTIS HC A07/MF A01 CSCL 09/2

This paper describes a theoretical framework and a LISP implementation for describing and simulating the cause-effect behavior of mechanisms. For the purposes of this research, a mechanism is defined to be any physical device, complex or simple, which exhibits cause and effect relationships useful to humans. Ordinarily, this will mean any purposively constructed object, such as a vacuum cleaner, a pencil, a button, a lightbulb or a computer. However, the authors also include in the definition any naturally-occurring physical devices and principles whose cause and effect relationships are of use to humans. Also considered are information-manipulating 'mechanisms' such as computer programs, as though they were physical in nature. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N77-23760 Missouri Univ., Columbia.
MODULAR REDUNDANCY TECHNIQUES FOR FAULT-TOLERANT DIGITAL SYSTEMS Ph.D. Thesis
Paulo Teixeira DeSousa 1976 194 p
Avail: Univ. Microfilms Order No. 77-4902

A historical perspective of fault-tolerant computing is presented, along with a systematic classification of techniques that are used to achieve ultrareliability. Modular redundancy is singled out among these techniques. The concept of compensating failures is incorporated into systems that use majority voting strategies. A monitored majority scheme, TMR/Simplex, is generalized to NMR/Simplex. In monitored schemes, a channel that fails is discarded along with one of the good channels. Siftout redundancy is developed to permit retention of the good channels by replacing the majority vote taken by a self-checking unit. A synthesis of modular redundancy techniques is undertaken and leads to General Modular Redundancy (GMR). A single reliability equation modeling all modular redundant schemes is given. Dissert. Abstr.

N77-23761# Danish Research Center for Applied Electronics, Hoersholm.
A DIGITAL DIFFERENTIAL ANALYSER. AN INTRODUCTION TO DIGITAL DIFFERENTIAL ANALYSERS AND AN EXAMPLE OF SIMULATION OF DIGITAL CIRCUITS USING REGISTER TRANSFER LANGUAGE DESCRIPTION

J. Molgaard Apr. 1976 74 p refs
(ECR-60) Avail: NTIS HC A04/MF A01

An introduction to the Digital Differential Analyser is provided as well as an example of simulation of a specific Digital Differential Analyser to be implemented in hybrid thick film technology. Detailed information on the simulation, which is performed using the assembler language of a minicomputer is presented. The four examples of the solution of differential equations, which show the applicability of the Digital Differential Analyser to both linear and nonlinear signal processing are included. Author

N77-23762# Royal Aircraft Establishment, Farnborough (England).
AN ESSAY ON COMPUTING
D. M. Gilbey Jul. 1976 25 p
(RAE-TM-MATH-7604; BR54529) Avail: NTIS HC A02/MF A01

The nature and difficulties of working on or with digital computer systems are presented in introductory terms. ESA

N77-23763# PRC Data Services, Inc., McLean, Va.
WORLD WIDE DATA MANAGEMENT SYSTEM (WWDMS) SELF INSTRUCTION MANUAL - T-2 VERSION (ADDENDUM A) Final Report, Dec. 1975 - Sep. 1976
Ronald A. Kogan 30 Sep. 1976 102 p
(Contract DCA100-73-C-0015)
(AD-A031655) Avail: NTIS HC A06/MF A01 CSCL 09/2

The purpose of the basic self instruction manual is to allow a person without prior experience in programming languages or data management systems to learn to use the World Wide Data Management System (WWDMS) as implemented on the Honeywell Series 6000 computer. The first section consists of elementary concepts and represents a stand-alone elementary user's self instruction manual. The second section contains advanced concepts, and when used in conjunction with the first section, comprises a complete advanced WWDMS user's self instruction manual. This report covers the first set of changes (Addendum A) to the manual. GRA

N77-23764# Bendix Research Labs., Southfield, Mich.
RPIE SYMBOL PLACEMENT ACCURACY Final Report
D. E. Westbrook Oct. 1976 59 p
(Contract DACA76-76-C-0005; BRL Proj. 2521)
(AD-A031647; BRL-8271; ETL-0076) Avail: NTIS HC A04/MF A01 CSCL 09/2

The Replacement of Photographic Imagery Equipment (RPIE) is a high-resolution, high-speed, large-format image restitution system. Its major purpose is to produce high-resolution orthophotos from panoramic photographs. A system generator is part of the system and is used to overprint symbols on the output orthophoto. Upon completion of RPIE development, it was found that symbols on some output orthophotos were not being placed accurately enough to meet user requirements. These symbol placement errors were noted only in the system's UNAMACE ONLINE operating mode. The objective of the RPIE Symbol Placement Accuracy Project was to locate and correct this problem. This report discusses the cause of symbol placement problems and documents the program changes made. Section 2 describes the source of the noted symbol placement errors, and section 3 discusses the minimization of those errors. Section 4 provides additions to the viewer operating sequence, and section 5 documents the changes that have been made to the original RPIE programs. Author (GRA)

N77-23765# Inco, Inc., McLean, Va.
AUTOMATED INTELLIGENCE PROCESSES EXERCISE AND REVIEW SYSTEM (AIPERS) Final Technical Report, 11 Jun. 1975 - 10 Jun. 1976
Lee A. Burcham, Marilyn Mills, Douglas J. Davis, and Marcia D. Sayre Griffiss AFB, N. Y. RADC Aug. 1976 110 p
(Contract F30602-75-C-0283)
(AD-A031742; Rept-1048-A002; RADC-TR-76-251) Avail: NTIS HC A06/MF A01 CSCL 09/2

This final technical report provides: (1) functional descriptions of and specifications for scenario generation with automated assists and scenario processing, (2) notes on methodologies for integrating decision impact analysis with exercise control, and (3) a user's guide for the AIPERS Demonstration Utility Prototype. Author (GRA)

N77-23766# Watervliet Arsenal, N.Y.
APPLICATION OF AUTOMATIC DRAFTING MACHINE
Victor H. Montouri Nov. 1976 57 p
(AD-A032939; WVT-TR-76042) Avail: NTIS HC A04/MF A01 CSCL 13/9

This report is a summary of applications on an automatic drafting machine utilizing the machine's drafting, the FORTRAN language, and interfacing with an interactive graphics system. Interfacing is accomplished by punched tape rather than a direct electronic communication. Some programs are included. Author (GRA)

N77-23767# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
THEORY OF FAULT TOLERANCE, VOLUME 1
L. A. Jack, W. L. Heimerdinger, Y. W. Han, and L. L. Kinney 7 Dec. 1976 57 p refs 2 Vol.
(Contract N00014-75-C-0011)
(AD-A034385; HONEYWELL-76-SRC/52) Avail: NTIS HC A04/MF A01 CSCL 09/2

The 1976 effort focused on exploring Labeled Graph properties which are prerequisites to successfully modeling important fault-tolerant phenomena. The modeling hierarchy task successfully demonstrated that Petri net structures could be reduced while preserving certain properties such as invariance and consistency. The second task which formalized the interface between the data transformation structure and the control structure indicated that a two-graph modeling approach was preferred over a combined single-graph approach. The data-fault task took a preliminary look at classifying various data faults in terms of their functional effects. The results suggest that there are a limited set of data-fault classes which accurately represent the types of data faults experienced in field equipment. Further work is required to complete the study of data faults. A separate task investigated the feasibility of developing a design for testability methodology which was a Navy-wide need identified at the Navy ATE workshop held at NELC. A framework for such a methodology was proposed, the current state of the art in design for testability was assessed and directions for Research and Development work were recommended. GRA

N77-23768# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
THEORY OF FAULT TOLERANCE. VOLUME 2: AN EXAMINATION OF A DESIGN FOR TESTABILITY METHODOLOGY Final Report
L. A. Jack 7 Dec. 1976 106 p refs 2 Vol.
(Contract N00014-75-C-0011)
(AD-A034386; HONEYWELL-76-SRC/53) Avail: NTIS HC A06/MF A01 CSCL 09/2

Until recently, system testing and support, like software, has been considered to be of secondary importance when compared to the major costs of hardware procurement. Now system complexity and labor rates have combined with decreasing digital hardware costs to change this emphasis. Thus a new emphasis has been placed on testability and maintainability of new systems. Field experience along with the results of the recent Navy ATE workshop held in San Diego show that designing for testability contributes the most toward the reduction of testing problems. Brute force application of built-in test techniques has been shown in the past to be an ineffective, costly solution. What is needed is a top down methodological approach to designing more testable systems with minimal cost impact. The primary purpose of this paper is to outline the components of such a methodology. The second objective is to assess the present state of the art in design for testability by reviewing current design practices. From this framework, the research and development efforts needed to support a design for testability methodology are recommended. GRA

N77-23769# Mitre Corp., Bedford, Mass.
HARDWARE SUBVERTER FOR THE HONEYWELL 6180
K. B. Henningan Dec. 1976 225 p refs
(Contract F19628-76-C-0001; AF Proj. 522N)
(AD-A034221; MTR-3280; ESD-TR-76-352) Avail: NTIS

HC A01/MF A01 CSCL 09/2

This report describes a software utility, the Multics Hardware Subverter, that will check on the reliability of Multics hardware operations. The H6180 Multics computer system incorporates many advanced hardware protection features including many features that were implemented via software techniques in the previous Multics system. Each of the hardware tests are described and the total operational capability of the hardware subverter is illustrated. Author (GRA)

N77-23770# Naval Undersea Center, San Diego, Calif. Dept. of Fleet Engineering.

PASCAL 1100 Research and Development Report, Sep. 1975 - Jun. 1976

M. S. Ball Sep. 1976 25 p refs

(XF21221701)

(AD-A033634; NUC-TP-527) Avail: NTIS HC A02/MF A01 CSCL 09/2

This document describes the PASCAL 1100 compiler and runtime system. It defines those items left undefined in the language report by Jensen and Wirth and describes local extensions to the language. In addition, it describes procedures for the use of the language under EXEC VIII. GRA

N77-23771# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

PDP-11/05 TO ELECTRON BEAM INTENSITY MODULATION UNIT INTERFACE M.S. Thesis

James R. Crowder Dec. 1976 105 p refs

(AD-A034028; GE/EE/76-19) Avail: NTIS HC A06/MF A01 CSCL 09/5

The result of this investigation is a design for an interface system which can be used to interface a Digital Electronic Corporation PDP-11/05 minicomputer with electron beam control electronics (EBCE). The EBCE is part of a deformable thermoplastic phase plate brassboard used for optical phase modulation in the Air Force Avionics Laboratory (AFAL/DHO). The interface is a modular design made up of a unibus interface, buffer, input control, output control, master control, and a digital to analog (D/A) converter. The buffer module uses two first-in-first-out (FIFO) buffers to alternately accept data from the PDP-11 and send data to the EBCE via the D/A converter. The 16 bit word of the PDP-11 is multiplexed into 8 bit data words for interface manipulation, since 8 bits offer adequate resolution for the EBCE. The interface is designed to allow writing of a 100 x 100 element matrix on the phase plate. This requires a 1.45 element/sec modulation rate of the analog signal sent to the EBCE. The use of a dual FIFO system, a multiplexed computer word, and a very fast D/A converter make this modulation rate possible.

Author (GRA)

N77-23772# Lincoln Lab., Mass. Inst. of Tech., Lexington.

MICROPROCESSOR REALIZATION OF A LINEAR PREDICTIVE VOCODER

Edward M. Hofstetter, Joseph Tierney, and Omar C. Wheeler 30 Sep. 1976 40 p refs

(Contract F19628-76-C-0002)

(AD-A033686; ESD-TR-76-302; TN-1976-37) Avail: NTIS HC A03/MF A01 CSCL 17/2

A microprocessor realization for a linear predictive vocoder is presented. The goal was a low power, low cost, compact special purpose realization of a narrow band speech terminal. The resultant design is a general purpose two bus structure running at a 150 ns cycle time using as the basic signal processing element four of the AMD 2901 CPE chips. This basic structure is augmented by a four cycle multiplier to allow for sufficient signal processing power. The design concessions that mark the lpcm as a special purpose machine designed to be a speech terminal are: limited I/O, and limited memory. The present design requires 162 dual-in-line packages, dissipates less than 45 watts and occupies about 1/3 cubic foot. Author (GRA)

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N77-23773 Michigan State Univ., East Lansing.

ON ALGORITHMS FOR NONLINEAR PREDICTION Ph.D. Thesis

Shashi Prabha Phoha 1976 73 p

Avail: Univ. Microfilms Order No. 77-5868

By introducing certain operations on vectors to define a matrix-algebraic structure on the past, a determinate mathematical problem is established and its solution demonstrated by a corresponding algorithm. A more efficient algorithm for the problem of non-linear prediction for multivariate processes is obtained by linearizing statistics of time-series to obtain the non-linear predictor. Transferring the non-linear prediction problem of a univariate stationary process to linear prediction of a related infinite-variate process is demonstrated. Dissert. Abstr.

N77-23774 George Washington Univ., Washington, D.C.

DETERMINATION OF A MINIMUM ROUTE COVER OF A COMPUTER PROGRAM Ph.D. Thesis

William Littell Bryan 1976 235 p

Avail: Univ. Microfilms Order No. 77-5280

Methods for determining the minimum number of test cases required for testing were explored, in order to assure that every branch of a program was tested at least once. Essentially, a computer program to be analyzed is first modelled as a directed, bilogic graph. Then a minimum cover of the graph model is determined, with the cover constrained to consist of routes from the entrances to the exits of the graph model. As a first step in that determination, the graph model is subjected to various transformations, in order to reduce its complexity and to reduce it to a canonical form. Such transformations include the provision of a single entrance and a single exit, the elimination of basic arcs, the transformation of graph circuits to an acyclic form, and the substitution for modelled subroutines. As a result of these transformations, the graph model is reduced in complexity, is acyclic, and has a single entrance and a single exit.

Dissert. Abstr.

N77-23775 New York Univ., N. Y.

ON ALGORITHMS FOR MINIMIZING THE NUMBER OF MULTIPLICATIONS IN MATRIX PRODUCTS Ph.D. Thesis

Julian David Laderman 1976 76 p

Avail: Univ. Microfilms Order No. 77-5423

The use of structural displays of systems of equations to define various useful equivalence relations among algorithms is discussed. By merging four structural displays, an algorithm is constructed requiring only 23 multiplications for the product of two 3 x 3 matrices. This algorithm is used to create improved algorithms for the product of square matrices corresponding to n=5, 6, 7, 9. By partitioning larger matrices, the algorithm yields improved noncommutative algorithms for an infinite number of other n x n matrix products. Dissert. Abstr.

N77-23776 California Univ., Berkeley.

TOWARD AUTOMATED VALIDATION OF COMPUTER PROGRAMS Ph.D. Thesis

Wen-Tsuen Chen 1976 146 p

Avail: Univ. Microfilms Order No. 77-4415

Techniques for automated validation of computer programs to enhance their reliability are investigated with special emphasis on validating large programs. Specific areas studied include: (1) static validation of program structure and semantics, (2) test data selection and automation of test data generation, and (3) dynamic validation of run-time control flow sequence and data property. In the static validation, the source text of a program is analyzed to detect and locate existing anomalies. Automated static validation techniques for checking both program structural and semantic aspects were investigated. In the dynamic validation, a program is validated during execution time to detect and locate remaining errors from the static validation phase.

Dissert. Abstr.

N77-23777 Oklahoma State Univ., Stillwater.
OPTIMAL DIGITAL MECHANIZATIONS OF STOCHASTIC FILTERING ALGORITHMS Ph.D. Thesis
Vijayendra Mohan Gupta 1976 105 p
Avail: Univ. Microfilms Order No. 77-5085

The basic objective of this research was the development of optimal discrete representations of continuous filtering algorithms for nonlinear stochastic systems. A systematic procedure is developed for simultaneously optimizing the nominal trajectory, the incremental filtering algorithm parameters, and the discrete representations on a speed-versus-accuracy basis. Several linear and nonlinear examples are included for comparison purposes. The developed procedure for the optimal discrete representation of the continuous filtering algorithms for nonlinear stochastic systems showed considerable improvement over the existing methods of filtering. The tradeoffs between the algorithm's accuracy and its computational speed were performed to conclude that an optimal value of the sampling period must be chosen to obtain the minimum cost functional. The trajectory optimization procedure showed a considerable reduction in estimation error over the basic optimal discrete representation for highly nonlinear systems. Dissert. Abstr.

N77-23778*# M&S Computing, Inc., Huntsville, Ala.
DRILL USER'S MANUAL
E. A. Pitts 17 Nov. 1976 20 p
(Contract NAS8-32113)
(NASA-CR-150259; Rept-76-0069) Avail: NTIS HC A02/MF A01 CSCL 09B

Instructions are given for using the DRILL computer program which converts data contained in an Interactive Computer Graphics System (IGDS) design file to production of a paper tape for driving a numerically controlled drilling machine. Author

N77-23779# Rice Univ., Houston, Tex.
COMPUTER ALGORITHMS FOR OPTIMIZATION THEORY
Angelo Miele 31 Aug. 1976 90 p refs
(Grants NSF GP-18522; NSF GP-27271; NSF GP-32453; NSF GP-41158; NSF MPS-75-18488)
(AAR-131) Avail: NTIS HC A05/MF A01

Problems lying in the following areas of applied mathematics were investigated: (1) search techniques, (2) solution of equations, (3) unconstrained minimization, (4) penalty function methods, (5) constrained minimization, (6) two-point boundary-value problems, and (7) optimal control problems. Optimum atmospheric flight trajectories, optimum extra-atmospheric flight trajectories, optimum aerodynamic shapes, and optimum structures were addressed. Author

N77-23780*# College of William and Mary, Williamsburg, Va.
ANALYSIS OF DISSECTION ALGORITHMS FOR VECTOR COMPUTERS
Alan George (Waterloo Univ., Ontario), W. G. Poole, Jr., and R. G. Voigt (NASA. Langley Res. Center) Mar. 1977 60 p refs
(Contracts NAS1-14101; N00014-75-C-0879)
(NASA-CR-145177; Rept-76-17) Avail: NTIS HC A04/MF A01 CSCL 09B

Dissection algorithms (one-way and incomplete nested dissection) were developed for solving the sparse positive definite linear systems arising from n by n grid problems along with vector computers (such as the CDC STAR-100 and TI ASC) for large scientific applications. An analysis of the use of dissection algorithms on vector computers dictates that vectors of maximum length be utilized thereby implying little or no dissection; on the other hand, minimizing multiplication counts suggests that considerable dissection be performed. The resolution of this conflict by minimizing the total time required by vectorized versions of the two algorithms is discussed. Author

N77-23781# Marconi Co. Ltd., Chelmsford (England). Mathematical Physics and Circuitry Group.
ANALYTIC TECHNIQUES FOR PROCESSING SIGNAL AND NOISE THROUGH A NON-LINEAR CHANNEL USING MODSIM. VOLUME 1: ANALYSIS METHODS AND PRELIMINARY RESULTS
G. A. Richards Feb. 1976 135 p refs 2 Vol.
(Contract ESTEC-2327/74-HP)
(ESA-CR(P)-878-Vol-1) Avail: NTIS HC A07/MF A01

In many applications of MODSIM, a simulation program, the behavior of a signal is required in a noisy nonlinear channel. Greater economy in the running of the program can be achieved by using analytical techniques to account for the effect of noise instead of performing multiple runs with different noise samples where it is difficult to assess the confidence limits. Three mathematical techniques which can be used to perform the analysis are described. The method most applicable uses a polynomial expansion of the nonlinear device characteristics and forms equivalent characteristics for processing the signal and noise. The noise after the nonlinear device is characterized by its autocorrelation function. Good agreement was obtained between the results of using this method and multiple runs of MODSIM. Author (ESA)

N77-23782# Naval Underwater Systems Center, New London, Conn.
MULTIVARIATE LINEAR PREDICTIVE SPECTRAL ANALYSIS EMPLOYING WEIGHTED FORWARD AND BACKWARD AVERAGING: A GENERALIZATION OF BURG'S ALGORITHM
Albert H. Nuttall 13 Oct. 1976 101 p refs
(NUSC Proj. A-752-05)
(AD-A031755; NUSC-TR-5501) Avail: NTIS HC A06/MF A01 CSCL 09/2

A method for multivariate linear predictive spectral analysis, employing weighted forward and backward averaging, is presented and programmed in FORTRAN. The method constitutes a generalization of Burg's univariate algorithm to the multivariate case. The essential analytical procedure is to minimize the trace of the sum of the weighted forward and backward error matrices by choice of the partial correlation coefficients, subject to a linear matrix constraint which guarantees that the forward-extrapolated and backward-extrapolated correlation matrix estimates are Hermitians of each other. The choice of error weighting is important and is discussed. Solution of a bilinear matrix equation is required in the algorithm. GRA

N77-23783# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
DISTRIBUTED COMPUTATION AND TENEX-RELATED ACTIVITIES Quarterly Progress Report, 1 May - 31 Jul. 1976
R. Schantz and R. Thomas Aug. 1976 18 p
(Contract N00014-75-C-0773; ARPA Order 2901; ARPA Order 2935)
(AD-A033085; BBN-3450; QPR-7) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report describes BBN efforts in the design of the National Software Works system and BBN efforts to integrate TENEX into the National Software Works system. BBN participation in the National Software Works project is divided into three major areas. These are system design, system implementation, and contractor/sponsor meetings to coordinate design and implementation goals and strategies. During this quarter most of the effort has been in the latter two areas. GRA

N77-23784# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
ERROR-CORRECTING SYNTAX ANALYSIS FOR TREE LANGUAGES Interim Report
S. Y. Lu and K. S. Fu Jul. 1976 93 p refs
(Grant AF-AFOSR-2661-74; AF Proj. 2304)
(AD-A032744; TR-EE76-24; AFOSR-76-1207TR) Avail: NTIS HC A05/MF A01 CSCL 12/1

An error-correcting version of tree automation is studied. Assume the syntax errors on trees to be of five types: substitution, stretch, split, branch, and deletion. The error-correction problem is to determine the distance between two trees as measured by the minimum cost sequence of error transformations needed to transform one to the other. Two types of error-correcting tree automation (ECTA) are proposed: structure-preserved ECTA and generalized ECTA. The structure-preserved ECTA takes substitution errors into consideration only. A LANDSAT data interpretation problem is used as an example to illustrate the process of structure-preserved ECTA. The restriction on tree structure is removed in formulating the generalized ECTA. All five types of syntax errors are considered. Any erroneous tree, in this case, is able to find its most similar (in terms of minimum distance)

correction in the sense of both node-labeling and tree structure.
Author (GRA)

N77-23785# Rensselaer Polytechnic Inst., Troy, N. Y. Computer Research Lab.
A PARAMETRIC ALGORITHM FOR DRAWING PICTURES OF SOLID OBJECTS BOUNDED BY QUADRIC SURFACES
Joshua Z. Levin Mar. 1976 70 p refs
(Contract AF-AFOSR-2937-76; AF Proj. 9769)
(AD-A032921; CRL-46; AFOSR-76-1161TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

An algorithm is described for generating two-dimensional, visible-line projections of three-dimensional objects that are bounded by patches of quadric surfaces. The main task of the algorithm is the calculation of intersections between quadric surfaces. A parameterization scheme is used. Each quadric-surface intersection curve (QSIC) is represented as a set of coefficients and parameter limits. Each value of the parameter represents at most two points, and these may easily be distinguished. This scheme can find the coordinates of points of even quartic (fourth-order) intersection curves, using equations of no more than second order. Methods of parameterization for each type of QSIC are discussed, as well as the problems of surface bounding and hidden-surface removal. Author (GRA)

N77-23786# Naval Academy, Annapolis, Md.
FREQUENCY ANALYSIS USING A MINICOMPUTER
D. C. Boch 17 May 1976 88 p refs
(AD-A032713; USNA-TSPR-75) Avail: NTIS HC A05/MF A01 CSCL 14/2

The spectral analysis of waveforms, whether these waves are acoustic or electrical in nature, has evolved into an important aspect of quite a wide variety of scientific endeavors. Utilized primarily by the Navy in the Study of underwater sound, frequency analysis also finds utility in research on mechanical vibrations, speech, music, et cetera. Real-time capability is necessary for many of these applications. That is, the transformation must be completed within the time interval over which its sampled data is acquired so that spectral plots may be generated on a continuing basis. The basis for a computer-aided frequency analysis scheme is known as a Discrete Fourier Transform, or DFT. The inherent flexibility of a general purpose computer lends itself quite well to the implementation of a high speed adaptation of the DFT, called a Fast Fourier Transform or FFT. Author (GRA)

N77-23787# Naval Electronics Lab. Center, San Diego, Calif.
MODESRCH, AN IMPROVED COMPUTER PROGRAM FOR OBTAINING ELF/VLF/LF MODE CONSTANTS IN AN EARTH-IONOSPHERE WAVEGUIDE
David G. Morfitt and Charles H. Shellman 1 Oct. 1976 235 p refs
(AD-A032573; NELC-IR-77T) Avail: NTIS HC A11/MF A01 CSCL 20/14

MODESRCH is a FORTRAN computer program designed to obtain rapidly, economically, and accurately, the mode constants needed to describe propagation in the earth-ionosphere waveguide at ELF, VLF and LF (10 Hz to 60 kHz). It is suggested that MODESRCH, along with required mode summing procedures, be used to replace 'waveguide' and 'wave-hop' codes currently used in network analysis programs which cover the ELF to LF frequency bands. This report contains a discussion of the analytical approach taken in MODESRCH, a FORTRAN listing of the program, instructions for using the program and some sample calculations. Author (GRA)

N77-23788# Naval Postgraduate School, Monterey, Calif.
STATISTICAL ANALYSIS OF NON-STATIONARY SERIES OF EVENTS IN A DATA BASE SYSTEM
Peter A. W. Lewis and Gerald S. Shelder (IBM Research Lab., San Jose, Calif.) Sep. 1976 55 p refs
(NR Proj. 042-284)
(AD-A033708; NPS-55LW76092) Avail: NTIS HC A04/MF A01 CSCL 12/1

Central problems in the performance evaluation of computer systems are the description of the behavior of the system and characterization of the workload. One approach to these problems comprises the interactive combination of data-analytic procedures with probability modelling. This paper describes methods, both old and new, for the statistical analysis of non-stationary univariate stochastic point processes and sequences of positive random variables. Such processes are frequently encountered in computer systems. As an illustration of the methodology, an analysis is given of the stochastic point process of transactions initiated in a running data base system. On the basis of the statistical analysis, a non-homogeneous Poisson process model for the transaction initiation process is postulated for periods of high system activity and found to be an adequate chracterization of the data. For periods of lower system activity, the transaction initiation process has a complex structure, with more clustering evident. Overall models of this type have application to the validation of proposed data base (sub) system models.
Author (GRA)

N77-23789# Naval Postgraduate School, Monterey, Calif.
SASE VI AND THE STATISTICAL ANALYSIS OF SERIES IN EVENT IN COMPUTER SYSTEMS
Peter A. W. Lewis Sep. 1976 25 p refs
(NR Proj. 042-284; RR0140501)
(AD-A033707; NPS-55LW76091) Avail: NTIS HC A02/MF A01 CSCL 12/1

Recent results in the development of methodology for the statistical analysis of univariate series of events (point processes) are described and some references to applications in the analysis and evaluation of computer system performance data are given. In addition, described is the SASE VI program which has been developed to implement a methodology for the statistical analysis of a series of events. Various subroutines perform, among other things, tests for monotone and cyclic trends, tests for renewal and Poisson processes, and two different types of spectral analysis. The program can also be used to analyze any series of positive random variables such as counts of events in successive fired time intervals in a point process. It has been programmed in both FORTRAN and APL. GRA

N77-23790# Stanford Univ., Calif. Systems Optimization Lab.
ON A CLASS OF LEAST-ELEMENT COMPLEMENTARITY PROBLEMS
Jong-Shi Pang Jun. 1976 49 p refs
(Contract F44620-74-C-0079; Grant NSF MCS-71-03341)
(AD-A032853; SU-SOL-76-10; AFOSR-76-1150TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The present paper studies linear complementarity problems which arise from the minimization of certain quadratic functions subject to upper and lower bounds on the variables. Two least-element characterizations of solutions to the above linear complementarity problem are established first. Next, a new and direct method to solve this class of problems, which depends on the idea of 'least-element solution' is presented. Finally, applications and computational experience with its implementation are discussed. GRA

N77-23791# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INTELLIGENT COMPUTER ASSISTED INSTRUCTION (CAI) APPLICATIONS Interim Report, Feb. - Sep. 1975
John Seely Brown, Richard Burton, Johan DeKleer, and Ned Benhaim Oct. 1976 84 p refs Sponsored in part by ARPA
(Contract F41609-75-C-0032; AF Proj. 1121)
(AD-A034844; AFHRL-TR-76-67) Avail: NTIS HC A05/MF A01 CSCL 05/9

Interim work is documented describing efforts to modify computer techniques used to recognize and process English language requests to an instructional simulator. The conversion from a hand-coded to a table driven technique are described in detail. Other modifications to a simulation based computer assisted instruction program to allow a gaming situation to be used in the classroom are also documented, and a student protocol taken with this program is presented. Textual support materials used in conjunction with the on-line computer instruction are also presented. GRA

N77-23792# Naval Research Lab., Washington, D. C.
MEAN AND VARIANCE OF THE CORRELATION MAGNITUDE OF RANDOM AND PSEUDONOISE SEQUENCES Interim Report
Loren S. Bearce and Arthur J. Ziffer 24 Nov. 1976 29 p refs

(AD-A034033; NRL-8068) Avail: NTIS HC A03/MF A01 CSCL 09/4

The mean or expected value and the variance of the absolute value of correlation between equal-length independent random sequences have been determined and compared with the same measures for full-period pseudonoise (PN) sequences, which have applied extensively in spread-spectrum radio communications systems. The magnitude of correlation is often of primary interest in such applications, since a strong negative correlation is as significant as a strong positive correlation; hence correlation detectors exist which function on the basis of the magnitude of correlation. The comparison reveals several advantages of the Gold codes which are due to their inherent mutual orthogonality. The study of random codes permits the performance evaluation of such detectors during periods of noise-only input and also provides a long-needed point of reference for PN system design. Author (GRA)

N77-23793# California Univ., Berkeley. Electronics Research Lab.

ADAPTIVE APPROXIMATION TECHNIQUES IN OPTIMIZATION Final Report

E. Polak Oct. 1976 12 p

(Contract DAAG29-73-C-0025)

(AD-A034009; ARO-11260.12-M) Avail: NTIS HC A02/MF A01 CSCL 12/2

This report describes the results in devising algorithms for solving three types of optimization problems: (1) nonlinear programming problems with both equality and inequality constraints, (2) nonlinear programming problems with functional constraints as well as ordinary equality and inequality constraints (these arise in engineering design), and (3) constrainted optimal control problems. These algorithms are presented in an implementable form which specifies all the important approximations. GRA

N77-23794# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AN ALGORITHM TO GENERATE AN OPTIMALLY HUMAN-SEPARABLE SYMBOL SET M.S. Thesis

James A. Johnson Dec. 1976 72 p refs

(AD-A034030; GE/EE/76D-26) Avail: NTIS HC A04/MF A01 CSCL 06/4

The purpose of this study was to develop an algorithm which could produce from a given symbol set a new symbol set that would be optimally separable by human subjects. A symbol change algorithm was developed based on the Fourier transform model of the human visual system and the inverse relationship between the number of human confusion errors that result from the basic shapes of symbols and the Euclidian distances between these symbols in the Fourier domain. The algorithm effectively changes the shape of certain symbols of a given symbol set by controlled manipulation of the symbol in the transform domain until a minimum, Euclidian distance threshold is achieved between the changed symbol and all other symbols in the set. A symbol set confusability number was also developed which can be used to evaluate different symbol sets with the lower number identifying the least confusable symbol set. GRA

N77-23795# Naval Research Lab., Washington, D. C.

VECTORIZED TRIDIAGONAL SOLVERS

J. P. Boris Nov. 1976 42 p refs

(RR140302)

(AD-A034845; NRL-MR-3408) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report briefly documents four related tridiagonal solvers optimized for parallel computation on the ASC computer at NRL. Both single and double precision versions are available. The report also contains listings of the routines and a test program with results for a standard test problem. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N77-23796 George Washington Univ., Washington, D.C.

THE DISTRIBUTED PIPELINE Ph.D. Thesis

Richard Gordon Cooper 1976 199 p

Avail: Univ. Microfilms Order No. 77-5281

Pipeline architectures have been used to implement highly concurrent computers. The distributed pipeline is an architecture which has certain advantages over the traditional pipeline for some applications: increased concurrency, throughput determined by average processing time, and the ability to operate at reduced size when one of the elements fails. Each element in a distributed pipeline can be programmed to implement a range of functions with little concern for speed matching. The distributed pipeline is therefore somewhat more general in application. A signal processing system is demonstrated. Fast Fourier transform computation by a distributed pipeline is analyzed with respect to program characteristics, and throughput and delay time are predicted. The system is simulated, and the agreement between prediction and simulation is exhibited. Dissert. Abstr.

N77-23797 Missouri Univ., Rolla.

STABILITY OF A CLASS OF NONLINEAR DISTRIBUTED-PARAMETER SYSTEMS Ph.D. Thesis

Robert Iman Egbert 1976 82 p

Avail: Univ. Microfilms Order No. 77-5553

A new method for determining the stability of a class of nonlinear systems containing distributed parameters is developed. The method reduces the problem of stability analysis of some nonlinear distributed systems to the problem of determining the stability of similar nonlinear systems containing less formidable lumped parameters. The method involves a frequency-domain stability criterion and the relationship between the frequency responses of the lumped system and the distributed system. The class of systems to which this method may be applied is defined and physical examples of such systems are given. Although the sufficient conditions for stability obtained by this method are somewhat conservative compared to conditions obtained from other stability criteria, simulations reveal that at least in some cases the performance of the distributed system is not significantly improved if the system is operated under the more liberal conditions. Dissert. Abstr.

N77-23798 Princeton Univ., N. J.

ANALYSIS AND DESIGN OF DIGITAL DATA TRANSMISSION SYSTEMS Ph.D. Thesis

Yih-Chyun Jenq 1976 121 p

Avail: Univ. Microfilms Order No. 77-4790

This is a simple approximation to the upper bound on the probability of error. The additive noise is not restricted to be Gausian. The approximate upper bound is twice the lower bound. Accuracy and simplicity of these bounds make a detailed analysis feasible. This analysis leads to a new strategy for the tap gain settings of a tapped delay line equalizer. The resulting equalizer tends to minimize the error probability for a wide class of additive noises. Computer simulation results show that the new equalizer has an error probability about 10 times smaller than that of a mean-square equalizer in the range of practical interest. Effects of timing offset and carrier phase error on the system performance are examined along the same line, and some sub-optimal solutions of pulse shape design are obtained. A QAM data communication system disturbed by additive Gaussian noise, intersymbol interference, and cross talk interference is studied in detail. The analysis predicts the existence of a threshold effect on the error probability due to carrier phase error. Good agreement between theory and computer simulation is obtained. Dissert. Abstr.

N77-23799# ERIA/ECA Automation, St. Cloud (France).

APPLIED RESEARCH STUDY OF A CONTROL SYSTEM FOR A COMPUTER NETWORK. VOLUME 1: STUDY CONCLUSIONS Final Report [UNE ETUDE DE RECHERCHE APPLIQUEE SUR UN SYSTEME DE CONTROLE DE RESEAU DE CALCULATEURS. VOLUME 1: CONCLUSIONS DE L'ETUDE]

Jun. 1976 16 p In FRENCH 2 Vol.

(Contract ESOC-RQ-209/75-AR)

(ESA-CR(P)-906-Vol-1) Avail: NTIS HC A02/MF A01

The establishment of a control system for a multicomputer network working in real time is discussed. The control center

envisaged necessitates a clear definition of the various operational objectives (hierarchy of applications) and reconfiguration strategies for software and equipment. The implementation of a control system should limit the overheads associated with the surveillance and reconfiguration tasks, making use of resources left available by the priority tasks. ESA

N77-23800# ERIA/ECA Automation, St. Cloud (France).
APPLIED RESEARCH STUDY OF A CONTROL SYSTEM FOR A COMPUTER NETWORK. VOLUME 2: PROPOSED CONTROL SYSTEMS Final Report [UNE ETUDE DE RECHERCHE APPLIQUEE SUR UN SYSTEME DE CONTROLE DE RESEAU DE CALCULATEURS. VOLUME 2: SYSTEMES DE CONTROLE PROPOSES]
Jun. 1976 75 p refs In FRENCH 2 Vol.
(Contract ESOC-RQ-209/75-AR)
(ESA-CR(P)-906-Vol-2) Avail: NTIS HC A04/MF A01

The establishment of a control system for a multicomputer network working in real time is discussed. The network structure (mesh or star) is taken into consideration. Solutions presented are: surveillance function distributed over the various computers and commanded by the control position; reconfiguration function combining manual reconfiguration command and automatic reconfiguration; speed lines capable of taking over network initialization and surveillance; and control information using the same intercomputer links as the operational data. ESA

N77-23801# Fondazione Ugo Bordoni, Rome (Italy).
FRONT- AND BACK-END MINICOMPUTER ARRANGEMENT IN MULTIPROGRAMMING ENVIRONMENT
Davide Grillo and Alessandro Perugia 15 May 1976 45 p refs Presented at the 2nd Intern. Workshop on Modeling and Performance Evaluation of Computer Systems, Stresa, Italy, 4-6 Oct. 1976
Avail: NTIS HC A03/MF A01

The throughput of an arrangement made up of two minicomputers, one dedicated to manage the periphery and to carry out a portion of the computing requirements (front-end function), the other dedicated to carry out the remainder of the computing requirements (back-end function) was investigated. Every job arriving at the system has to be processed first by the front-end and again before it may leave the system. The queueing discipline is FCFS for the jobs waiting to be serviced by the back-end, whereas jobs waiting to be serviced by the front-end have different scheduling, according to whether they have not yet been processed (priority) or have already been processed (preempty-resume). ESA

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N77-23802 California Univ., Berkeley.
OPTIMAL ADAPTIVE CONTROL OF LINEAR DISTRIBUTED-PARAMETER SYSTEMS WITH QUADRATIC CRITERIA Ph.D. Thesis
Calvin B. Y. Lee 1976 70 p
Avail: Univ. Microfilms Order No. 77-4507

Various aspects of the problem of optimal control of a linear distributed-parameter system with quadratic criteria were treated. Both distributed and boundary control terms were present. The boundary control term entered the system through a dynamical process on the boundary. First, certain deterministic versions of the problem were solved. This includes the case where there was a fixed terminal-time boundary condition. Next, random spacially-distributed disturbances were introduced into the dynamical equations of the deterministic model. A certainty equivalence result was obtained for this stochastic control problem. Finally, a Bayesian approach was used to establish a separation principle for the adaptive version of the problem. Dissert. Abstr.

N77-23803# Engins Matra, Velizy (France).
STUDY OF ATTITUDE CONTROL LOOPS IMPLEMENTATION USING ADAPTIVE CONTROL ELECTRONICS Final Report
R. Havas, M. Germain, and J. Pierron Jan. 1977 294 p refs
(Contract ESTEC-2577/75-AK)
(Rept-30/627; ESA-CR(P)-917) Avail: NTIS HC A13/MF A01

The development of the software coding the control laws of Meteosat during transfer orbit and OTS roll-yaw control during stationkeeping maneuvers is described. The software is coded in 8080 (INTEL) language. Control techniques are identical to those to be used on OTS and Meteosat. The control programmable electronics is the Adaptive Control Electronics, built around an 8080 A microcompressor chip. Control loops were analyzed in the light of sampled, discrete level data. Digitalization methods of linear filters and corrector networks with finite length words are given. Block diagrams and flow charts are presented for control laws, and the software structure is discussed. Test and validation procedures are described. ESA

N77-23804# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
SPOKEN WORK RECOGNITION USING STATISTICAL AND SYNTACTIC METHODS IN MULTI-TALKER ENVIRONMENT
M. C. Mittal and R. L. Kashyap Aug. 1976 135 p refs
(Grant AF-AFOSR-2661-74; AF Proj. 2304)
(AD-A033213; AFOSR-76-1245TR; TR-CC76-28) Avail: NTIS HC A07/MF A01 CSCL 17/2

This work focuses on the recognition of spoken words in multi-talker environment. A new method of recognizing spoken words belonging to a given vocabulary spoken by a number of speakers, the identity of speaker being unknown to the system, is described and the experimental results reported. In the present work, the vocabulary has 40 words spoken by six speakers. The vocabulary consists of many pairs of words which are phonemically similar to each other. A recognition rate of 99 percent was obtained by testing about 400 word utterances. An attempt is made to use the same technique for recognizing phrases made up of 2-3 words. GRA

N77-23805# Brown Univ., Providence, R. I. Div. of Engineering.
A NOTE ON FEEDBACK STABILIZATION OF A DIFFERENTIAL DIFFERENCE SYSTEM Interim Report
W. H. Kwon and A. E. Pearson 1976 10 p refs
(Grant AF-AFOSR-2793-75; AF Proj. 9769)
(AD-A032825; AFOSR-76-1145TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Sufficient conditions for linear constant differential-difference systems to be memoryless stabilizable are derived. The proof is constructive in that an easily computable stabilizing feedback control law is obtained. The results in this note are stronger than some stabilization results in previous papers. GRA

N77-23806# California Univ., Irvine. School of Engineering.
CONTROL SYSTEMS THEORY Final Report, 1 Jul. 1971 - 30 Jun. 1976
J. S. Meditch and A. R. Stubberud Aug. 1976 22 p refs
(Grant AF-AFOSR-2116-71; AF Proj. 2304)
(AD-A032998; AFOSR-76-1174TR) Avail: NTIS HC A02/MF A01 CSCL 09/4

Research conducted under AFOSR Grant 71-2116, Control Systems Theory, is comprehensively reviewed. The work is classified into two major categories of estimation theory and control theory. Within the former, results are reported in the areas of polynomial filtering, adaptive filtering, data smoothing, applied estimation theory, observer theory, and data compression and random sampling. In the latter, the focus is on multivariable control system design, and the research presented is in the areas of computer-aided design, design theory, controls-configured systems, and multivariable servomechanisms. A chronological listing of 45 publications and 9 Ph.D. theses that resulted from the research supported by the grant is included. GRA

N77-23807# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering.
AN ALGEBRAIC TOPOLOGICAL APPROACH TO STABILITY THEORY Interim Report
R. DeCarlo Apr. 1976 46 p refs

(Grant AF-AFOSR-2631-74; AF Proj. 9749)
(AD-A032826; AFOSR-76-1147TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Stability theory using frequency domain techniques essentially began with the advent of the Nyquist Criterion. The real meaning of this criterion seemed clouded by the complexity of its proof. The usual proof depends heavily on the argument principle. This supplies unneeded information in that it counts the number of encirclements of '-1'. System stability requires only a binary decision on the number of encirclements. Using Homotopy Theory, a branch of Algebraic Topology, new proofs of the classical Nyquist Criterion along with the more recent multivariable results are constructed. In both cases the proofs are essentially the same. Moreover they offer an intuitively satisfying approach to the stability question. These ideas are then generalized to a Nyquist-like test for the stability of multidimensional digital filters. Basically, the test is a series of Nyquist tests, each of which is more or less easily implemented on a computer. In particular, a kinship between the distinguished boundary of the polydisk and the classical Nyquist contour is established. A special form of homotopy is also defined. It is this special definition of homotopy that suitably describes the stability of multidimensional digital filters characterized by transfer functions in several complex variables. GRA

N77-23808# California Univ., Los Angeles. Dept. of Computer Science.
PICTURE DECOMPOSITION, TREE DATA-STRUCTURES AND IDENTIFYING DIRECTIONAL SYMMETRIES AND NODE COMBINATIONS Interim Report
Nikitas Alexandridis and Allen Klinger Sep. 1976 99 p refs
(Grant AF-AFOSR-2384-72)
(AD-A033289; UCLA-ENG-7684; AFOSR-76-1220TR) Avail: NTIS HC A05/MF A01 CSCL 14/5

The general problem treated in this report is that of extracting structural information from an object in a scene. In particular, symmetries are used as another--in addition to the average intensity values--global coarse picture parameter subregion characteristic, of a picture that has been regularly decomposed to a dimensionally reduced subset. Regular decomposition is a procedure through which a picture is subdivided in a particular way, leading to a data structure representation of the information which preserves geometric and topological relationships among pixels or among aggregates of pixels (substructures) found in the original picture. GRA

N77-23809# Maryland Univ., College Park. Computer Science Center.
PIECEWISE APPROXIMATION OF PICTURES: FURTHER EXPERIMENTS
Narendra Ahuja, Larry S. Davis, David L. Milgram, and Azriel Rosenfeld Jul. 1976 31 p refs
(Contract F44620-72-C-0062)
(AD-A033036; AFOSR-76-1135TR; TR-462) Avail: NTIS HC A03/MF A01 CSCL 14/5

In an earlier report, a new method of generating skeleton representations of noisy, grayscale pictures was described. This supplemental report investigates some variations on the basic method, and also shows that approximations to the picture can be constructed, given its skeleton. Author (GRA)

N77-23810# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
SENSITIVITY OPERATORS AND ASSOCIATED SYSTEM CONCEPTS FOR LINEAR DYNAMIC SYSTEMS Ph.D. Thesis. Final Report
J. Gary Reid Jul. 1976 211 p refs
(AFIT Proj. 00-01)
(AD-A034057; AFAL-TR-76-118) Avail: NTIS HC A10/MF A01 CSCL 12/1

Output parameter sensitivity for linear dynamic systems is treated in an operator framework. Parameter sensitivity is derived for a general linear system defined as the sum of linear operators on the initial state and control input. The sensitivity-related properties of insensitivity, sensitivity controllability, parameter identification and identifiability, and optimal control design for both minimum sensitivity and improved identification are then dealt with in terms of the sensitivity operators and their adjoints. This theoretical foundation is applied to give fundamental descriptions of the parameter sensitivities in linear ordinary differential equation systems. The discussion focuses on linear time-invariant systems where a new algebraic representation of the parameter sensitivities is obtained. GRA

N77-23811# Naval Research Lab., Washington, D. C. Computer Science Lab.
APPLICATION OF AUTOMATIC CLUSTERING TO EMITTER IDENTIFICATION Interim Report
James Slagle and Richard C. T. Lee Nov. 1976 14 p refs
(NRL Proj. B02-23)
(AD-A033916; NRL-MR-3407) Avail: NTIS HC A02/MF A01 CSCL 12/1

The goal of clustering is the partitioning of a given set of objects into subsets called clusters in such a way that the objects in a cluster are similar to one another and that objects in different clusters are dissimilar. Clustering may help in getting a more or less direct understanding of the relationships among the objects, and it may be useful as a first step in pattern recognition. Some possible applications are automatic phoneme recognition, data base management systems, personnel classification, detection of errors in files and computer security. Several clustering methods were applied to data sets of practical importance. Automatic pattern recognition using the k nearest neighbors was applied. An efficient method for selecting a good subset from the full of 44 features was tried. In all cases, the results were good. Author (GRA)

N77-23812# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Guidance and Control Directorate.
ANALYSIS AND DESIGN OF DIGITAL CONTROL SYSTEMS. PART 2: PRINCIPLES AND TECHNIQUES
R. E. Yates, Y. T. Tsay, and C. F. Chen 29 Oct. 1976 214 p refs
(DA Proj. 1M3-62303-A-214)
(AD-A034027; RG-77-3) Avail: NTIS HC A10/MF A01 CSCL 09/4

In discrete-time feedback control system design, the use of nonrecursive compensators has advantages. However, the existing methods for designing such compensators are difficult. This report (1) lays the foundation necessary to understand window effects by investigating the basic properties of Gibbs' phenomena in both the time and the frequency domains, (2) analyzes the stability and performance aspects of discrete-time feedback systems via the Fast Fourier Transform (FFT) algorithm, and (3) formulates a computer-oriented nonrecursive compensator design procedure. Author (GRA)

N77-23813# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
FILLING-IN THE GAPS: THE SHAPE OF SUBJECTIVE CONTOURS AND A MODEL FOR THEIR GENERATION
Shimon Ullman Oct. 1976 22 p refs
(Contract N00014-75-C-0643)
(AD-A034091; AI-M-367) Avail: NTIS HC A02/MF A01 CSCL 09/4

The properties of isotropy, smoothness, minimum curvature and locality suggest the shape of filled-in contours between two boundary edges. The contours are composed of the arcs of two circles tangent to the given edges, meeting smoothly, and minimizing the total curvature. It is shown that shapes meeting all the above requirements can be generated by a network which performs simple, local computations. It is suggested that the filling-in process plays an important role in the early processing of visual information. Author (GRA)

N77-23814# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
SYNTHESIZING CONSTRAINT EXPRESSIONS
Eugene C. Freuder Jul. 1976 33 p refs
(Contract N00014-75-C-0643)
(AD-A034011; AI-M-370) Avail: NTIS HC A03/MF A01 CSCL 12/2

An algorithm is presented for determining the values which simultaneously satisfy a set of relations, or contraints, involving different subsets of n variables. The relations are represented in

a series of constraint networks, which ultimately contain a node for every subset of the n variables. Constraints may be propagated through such networks in (potentially) parallel fashion to determine the values which simultaneously satisfy all the constraints. The iterated constraint propagation serves to mitigate combinatorial explosion. Applications in scene analysis, graph theory, and backtrack search are provided. Author (GRA)

N77-23815# Colorado Univ., Boulder. Dept. of Electrical Engineering.
FEEDBACK SYSTEM THEORY Interim Report, 1 Nov. 1975 - 31 Oct. 1976
Isaac M. Horowitz 7 Dec. 1976 9 p refs
(Grant AF-AFOSR-2946-76)
(AD-A033838; AFOSR-76-1466TR) Avail: NTIS HC A02/MF A01 CSCL 12/2

The two major research efforts were in the areas of (1) nonminimum-phase linear and nonlinear time-varying systems, and (2) multiple-loop single input-output systems. In both areas, the objective was to develop synthesis techniques to achieve assigned system performance specifications, despite significant uncertainty in a constrained part (plant) of the system. In the first area, it was necessary to first solve the optimal linear time invariant nonminimum-phase problem. This enabled the solution of the linear time-varying nonminimum-phase problem. Progress was made on the nonlinear time-varying case. In the second area, an optimal design technique was completed for the simplest (two-loop) noncascade system, and it appears promising that the same design philosophy can be used for more complex structures. GRA

N77-23816# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
CONVERGENCE OF RECURSIVE ADAPTIVE AND IDENTIFICATION PROCEDURES VIA WEAK CONVERGENCE THEORY Interim Report
Harold J. Kushner 1976 35 p refs
(Contract N00014-76-C-0279; Grant AF-AFOSR-3063-76)
(AD-A033789; AFOSR-76-1410TR) Avail: NTIS HC A03/MF A01 CSCL 12/2

Results and concepts in the theory of weak convergence of a sequence of probability measures are applied to convergence problems for a variety of recursive adaptive (stochastic approximation like) methods. Similar techniques have had wide applicability in areas of operations research and in some other areas in stochastic control. It is quite likely that they will play a much more important role in control theory than they do at present, since they allow relatively simple and natural proofs for many types of convergence and approximation problems. Part of the aim of the paper is tutorial: to introduce the ideas, and to show how they might be applied. Also, many of the results are new, and they can all be generalized in many directions. Author (GRA)

N77-23817# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A CONSOLIDATED COMPUTER PROGRAM FOR CONTROL SYSTEM DESIGN (CCPCSD) M.S. Thesis
Frederic L. OBrien Dec. 1976 223 p refs
(AD-A034879; GE/EE/76D-38) Avail: NTIS HC A10/MF A01 CSCL 09/2

Several different computer programs have been independently developed for control system design and analysis. Each program may have its own input and output formats (different from any other), and each program may have its own operating philosophy. This report describes CCPCSD and its development, its specifications, organization, realization, testing, and results. The CCPCSD contains 4 previously written A.F. Inst. of Technology computer programs for control system design algorithms (ROOTL, FREQR, PARTL, and POLY) and a lead-in program which controls the overall flow of CCPCSD. An overlay structure is used. The structure consists principally of an executive (main) overlay and four primary overlays (one for each subprogram mentioned above). Each subprogram is modified towards standardizing inputs, termination procedures, and data structure (where feasible). CCPCSD is developed to be used by control systems engineers and/or students. This computer-aided design tool can be operated from an intercom terminal, where operator-computer interaction takes place. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N77-23818 Oklahoma State Univ., Stillwater.
ON THE JOINT DISTRIBUTION OF COVERAGES Ph.D. Thesis
Pao-liang Chen 1976 113 p
Avail: Univ. Microfilms Order No. 77-5049

The joint distribution of linear and rectangular coverages was studied. The primary emphasis was on the situation in which one rectangular pattern is delivered on two rectangular targets. A way to extend the results of the study of m targets and n passes was investigated. The cumulative distribution function (c.d.f.) and the probability density function (p.d.f.) of one linear coverage, the c.d.f. and the p.d.f. of one rectangular coverage, the joint c.d.f. and the joint p.d.f. of two linear coverages were all derived. A way to approximate the joint distribution of two rectangular coverages was devised. The joint probabilities of some interesting events were found in exact and closed form. This study was extended to the case of m targets. The extension to n passes was done only for events involving Hitting-Missing. Dissert. Abstr.

N77-23819 Oklahoma State Univ., Stillwater.
COMPARATIVE TECHNIQUES FOR THE EVALUATION OF CLUSTERING METHODS Ph.D. Thesis
Janice Lynn Dubien 1976 179 p
Avail: Univ. Microfilms Order No. 77-5065

The use of clustering methods to solve the problem of classifying m individuals (generic) into k homogeneous populations on the basis of n observable characteristics was studied. Important considerations for comparing clustering methods were first determined. The effect of correlated variables on the 'retrieval' ability of a class of agglomerative clustering methods was then evaluated. The agglomerative clustering methods used in the empirical investigation were chosen on the basis of an algebraic analysis of agglomerative clustering method algorithms. The properties of the comparative statistic employed in the empirical investigation were also studied. Dissert. Abstr.

N77-23820 Montana State Univ., Missoula.
ESTIMATION OF CUMULATIVE TOTALS Ph.D. Thesis
Charles Edward Shaffer 1976 144 p
Avail: Univ. Microfilms Order No. 77-4978

The estimation of a cumulative total is investigated through the use of two groups of estimators. The first group is comprised of standard estimation procedures but with corrections in the standard deviations of the estimated cumulative totals. The second group involves ratio estimate procedures also with corrections in the standard deviations. The estimators are then compared theoretically based in these variances and through a Monte Carlo study under various conditions. Dissert. Abstr.

N77-23821 Southern Illinois Univ., Carbondale.
APPROXIMATION BY EXPONENTIAL SUMS Ph.D. Thesis
Robert Joseph McGlinn 1976 99 p
Avail: Univ. Microfilms Order No. 77-6238

A Remez type exchange procedure is developed for finding best uniform approximations to completely monotone functions on closed subsets of (0, infinity). Numerical results for the completely monotone function F(t) - 1/(1+t) are retabulated. Dissert. Abstr.

N77-23822 New York Univ., N. Y.
DENSITIES OF POLYNOMIALS AND NONEXISTENCE OF POWERFUL MINIMAL BASES Ph.D. Thesis
Ben Wayne Miller 1976 45 p
Avail: Univ. Microfilms Order No. 77-5438

The density in the set of all monic polynomials of degree n of the Dedekind-Type polynomials for the prime p of that degree n is studied for all primes p and degrees n. This density is

proven to exist in all cases. It is calculated explicitly in the cubic case, and bounds are produced in the general case insuring that the density is strictly greater than zero and strictly less than a uniform constant less than one. The question of the density of these polynomials leads to the more general question of determining the density of the monic polynomials of a given degree which factor in some given way over the p-adic integers. After first proving that these densities always exist, they are calculated explicitly for the case of quadratic polynomials for all primes p and for the case of cubic polynomials for the prime 2, and limiting values are determined for all degrees as the prime p increases to infinity. Dissert. Abstr.

N77-23823 California Univ., Berkeley.
A NUMERICAL AND ANALYTICAL STUDY OF ANOMALOUS PROPAGATION OF ELECTRICAL IMPULSES IN DAMAGED HEART FIBERS Ph.D. Thesis
Robert Naham Miller 1976 93 p
Avail: Univ. Microfilms Order No. 77-4540

Electrophysiological experiments on the Purkinje fibers were investigated with the purpose of constructing a mathematical framework in which hypotheses about these experiments could be tested. The first experiments concerned current-voltage relations for the plateau of the action potential of the space-clamped Purkinje fiber. The experimental data was used to construct a quantitative model of the electrical behavior of the membrane. The other experimental results studied concerned anomalous propagation effects in Purkinje fibers for the case where a portion of the length of the fiber is rendered inexcitable by encasing it in an agar block whose ionic composition differs greatly from that of the normal extracellular fluid. A qualitative model was derived to simulate the effects observed and to investigate the phenomena of delay and one-way conduction. Dissert. Abstr.

N77-23824 Massachusetts Univ., Amherst.
THE HASSE PRINCIPLE ALGEBRAS OVER FUNCTION FIELDS OF GENUS 0 AND 1 Ph.D. Thesis
Terry Allen Nyman 1976 73 p
Avail: Univ. Microfilms Order No. 77-6457

The problem of whether the Hasse-Brauer-Noether theorem for simple central algebras over number fields could be extended to algebras over certain fields of algebraic functions in one variable was investigated. This theorem states that a simple algebra with center a number field k splits over k if and only if it splits over the completion of k at every rank one valuation of k. The investigation began with algebras over rational function fields K = k(t). The valuations involved here were rank one valuations of K which are trivial on k. Algebras over fields of algebraic functions in one variable were then considered. K = k(t,s) with K algebraic over the rational function field k(t). Dissert. Abstr.

N77-23825 California Univ., Berkeley.
THETA SERIES OF QUADRATIC FORMS AND MODULAR FORMS FOR GAMMA (0) (N) Ph.D. Thesis
Walter Raymond Parry 1976 31 p
Avail: Univ. Microfilms Order No. 77-4565

The problem of whether or not every element in the complex vector space S sub k (Gamma(0)(N)) is a C-linear combination of generalized theta series is considered. The case where N is the square of a prime less than or equal to 23 and k = 2 is solved. In particular it is shown that not every cusp form of weight 2 with respect to Gamma (0)(N)(13 squared) is a C-linear combination of theta series of G-forms of levels p and p squared. Dissert. Abstr.

N77-23826 New York Univ., N. Y.
MULTI-TIME AVERAGING METHODS FOR SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS WITH A SMALL PARAMETER Ph.D. Thesis
Stephen Charles Persek 1976 209 p
Avail: Univ. Microfilms Order No. 77-5449

Systems of ordinary differential equations with a small parameter epsilon are considered, where the linear part of the system, to order one in epsilon, corresponds to combinations of oscillatory, stationary, and/or decaying modes. The conventional averaging method is discussed, and the existence of solutions to the original system and their uniform approximation is proved for the interval, zero to infinity, for averaged systems with various asymptotic stability properties. Dissert. Abstr.

N77-23827 Wisconsin Univ., Madison.
RANDOM LINEAR TRANSFORMATIONS OF POINT PROCESSES Ph.D. Thesis
Harry Michael Pierson 1976 88 p
Avail: Univ. Microfilms Order No. 76-28171

Many results involving transformations or operations on point processes have the common feature of treating points individually. Examples of such transformations include independent motions, independent thinnings, superposition of independent processes, and clustering. The type of transformation considered here is different because it involves neighbor influence. Dissert. Abstr.

N77-23828 New York Univ., N. Y.
AN APPROACH TO GEOMETRY VIA TRANSFORMATIONS AS DERIVED FROM THE AXIOMS OF GIUSEPPE PEANO Ph.D. Thesis
Maxine Martha Rosman 1976 306 p
Avail: Univ. Microfilms Order No. 77-5331

Highlights of two relatively obscure articles on geometry by Giuseppe Peano are discussed. The first of the two articles emphasizes the rigorization of geometry through the rigorization of language; an entire new symbolism was invented for this purpose. In the second article, a set of axioms of motion was added to the set of axioms given in the first article. A brief development of Euclidean plane geometry is presented using these axioms. In addition, two possible coordinate approaches to Euclidean geometry, an oblique rectilinear coordinate system and a polar coordinate system, are developed. Finally, it is shown how matrices may be used to relate the coordinates of one rectilinear coordinate system to the coordinates of another rectilinear coordinate system. Dissert. Abstr.

N77-23829 New York Univ., N. Y.
COMPLEMENTS OF CODIMENSION-TWO SUBMANIFOLDS Ph.D. Thesis
Justin Richard Smith 1976 149 p
Avail: Univ. Microfilms Order No. 77-5468

The complements were studied of codimension-two submanifolds of compact manifolds by using the theory of homology Poincare imbeddings and their realizations. The homotopy type of the complement of a realization of a Poincare imbedding was studied. In some cases, necessary and sufficient conditions are obtained for a group to be the fundamental group of the complement of a locally-flat realization of a codimension-two Poincare imbedding. Furthermore, conditions are obtained for modules to be the homology modules of the complement of a locally-flat realization of a Poincare imbedding. In some cases simultaneous characterizations are obtained for all of the homology modules of the complements of locally-flat realizations of a Poincare imbedding. An exact sequence is developed that can be used to determine the set of cobordism classes of realizations of a Poincare imbedding. Dissert. Abstr.

N77-23830 California Univ., Berkeley.
A NUMERICAL SOLUTION OF BOLTZMANN'S EQUATION Ph.D. Thesis
Gary Andrew Sod 1976 118 p
Avail: Univ. Microfilms Order No. 77-4605

The numerical solution of Boltzmann's equation is considered for a gas model consisting of rigid spheres by means of Hilbert's expansion. If only the first two terms of the expansion are retained, Boltzmann's equation reduces to the Boltzmann-Hilbert integral equation. Successive terms in the Hilbert expansion are obtained by solving the same integral equation with a different source term. The Boltzmann-Hilbert integral equation is solved by a new very fast numerical method. The success of the method rests upon the simultaneous use of four judiciously chosen expansions; Hilbert's expansion for the distribution function, another expansion of the distribution function in terms of Hermite polynomials, the expansion of the kernel in terms of the eigenvalues and eigenfunctions of the Hilbert operator, and an expansion involved in solving a system of linear equations through a singular value decomposition. The numerical method is applied to the study of the shock structure in one space dimension.

Numerical results are presented for Mach numbers of 1.1 and 1.6. Dissert. Abstr.

N77-23831 California Univ., Berkeley.
THE ALGEBRAIC STRUCTURE OF A CONTINUOUS LINEAR OPERATOR ON A FRECHET SPACE Ph.D. Thesis
Marc Phillip Thomas 1976 105 p
Avail: Univ. Microfilms Order No. 77-4623

Let X be a locally convex Frechet space and let T be a continuous linear operator on X; then X becomes a C[x] module under px = p(T)x for p eta C[N], x eta X. As a module over a principal ideal domain, X has a largest divisible submodule D(T). Let S be a linear function from X to X such that ST = TS. S is not assumed continuous. It is shown that SD(T) is not contained in D(T) and hence S drops to an operator S of S sub 1 by S. It is shown that S is continuous and that S sub 1 has a nice matrix decomposition as a consequence of the above algebraic structure of D(T). Finally, let T be a quasinilpotent operator on a Banach space X. Suppose that sigma sub p (T) = phi and TX = X. It is shown that a closed T invariant subspace K of X is algebraically complemented if and only if Tx eta K implies x eta K. Dissert. Abstr.

N77-23832 Michigan Univ., Ann Arbor.
CONTRIBUTIONS TO THE THEORY OF FUNCTIONAL DIFFERENTIAL EQUATIONS WITH INFINITE DELAY Ph.D. Thesis
Harlan West Stech 1976 134 p
Avail: Univ. Microfilms Order No. 77-5894

Functional differential equations are discussed in the context of a phase space. The adjoint theory for linear autonomous equations is considered from the point of view of adjoint semi-group theory. The adjoint equation is derived, and the space decomposition at characteristic values is given in terms of an extension of the classic bilinear form known for finite delay equations. General linear systems and their adjoints are discussed in a manner similar to that for finite delay equations. It is shown that the spectrum of the usual solution operator T(t,s), t > s consists entirely of normal eigenvalues outside the circle of radius exponent Beta(s-t). The behavior of solutions near periodic solutions to nonlinear FDE's is considered. Conditions are given under which the Poincare map can be defined about nondegenerate periodic orbits. The Poincare map is then used to discuss the stability of the periodic orbit. Dissert. Abstr.

N77-23833 Adelphi Univ., Garden City, N. Y.
ON PROPERTIES OF DIAGNOLIZATIONS OF CERTAIN SEQUENCES Ph.D. Thesis
Erwin Just 1976 141 p
Avail: Univ. Microfilms Order No. 77-4327

A collection of results is presented which describes properties of certain sets of rational numbers and algebraic numbers, and selected real numbers which are associated with permutations of certain sets of rational numbers and algebraic numbers. The motivations for these explorations derive from the Cantor diagonal process which was used by Georg Cantor in his development of the theory of sets. The results focus attention mainly on arrangements of selected sets of rational numbers expressed with the convention that terminating rationals are to end in a string of nines (or in a string of digits each equal to k-1 when the numbers are expressed in scale k). Special properties of the diagonals produced by the various permutations of the set of all rational numbers contained in (0,1](in scale >2) are also revealed. Every one of these diagonals has the property that if each digit is replaced by another digit the resulting number is also irrational. Such numbers are called strong irrationals. It is shown that almost all numbers (in the measure sense) are strong. Irrationals, and a number is a strong irrational if and only if it is the main diagonal of some permutation of the set of rationals. Additional results are obtained in analogous fashion by permuting the set of algebraic numbers. Dissert. Abstr.

N77-23834 Kansas State Univ., Manhattan.
SOME RESULTS IN FOURIER ANALYSIS ON GROUPS Ph.D. Thesis
Patrick Ray Gardner 1976 43 p
Avail: Univ. Microfilms Order No. 77-5502

Solutions are given for three problems concerning the algebra A(G), where G is a locally compact Abelian group, and its related A sup P (G) algebras. Topics discussed include multiplier space, complex value functions, and spectral synthesis. Sets of continuity are defined and used with certain multiplier techniques to generalize several results found in the literature. Dissert. Abstr.

N77-23835 California Univ., Berkeley.
COMPACT PERTURBATIONS OF OPERATOR ALGEBRAS Ph.D. Thesis
Kenneth Ralph Davidson 1976 30 p
Avail: Univ. Microfilms Order No. 77-4432

It has been proven that an operator on H2 of the disc commutes modulo the compacts with all analytic Toeplitz operators if and only if it is a compact perturbation of a Toeplitz operator with symbol in H infinity + C. Hence the image in the Calkin algebra of the Toeplitz operators with symbol in H infinity + C is maximal Abelian. It follows that the essential commutant of the whole Toeplitz algebra is the algebra of Toeplitz operators with symbol in QC. These results lead to an explicit characterization of the automorphisms of the algebra of compact perturbations of the analytic Toeplitz operators. The set of essentially invariant projections of an operator algebra is considered. It is proved that if sigma is a weakly closed algebra containing a maximal Abelian von Neumann algebra, then every essentially invariant projection is a compact perturbation of an invariant projection. Dissert. Abstr.

N77-23836 California Univ., Berkeley.
SAMPLING AND TIME SERIES ANALYSIS Ph.D. Thesis
Daneshmand Firouzabadi 1976 86 p
Avail: Univ. Microfilms Order No. 77-4430

The problem of estimating the level (mean) and the change of a time dependent population is considered. Efficient estimates of the level and the change are derived when the population is subjected to repeated sampling in time. It is shown that estimates derived in [23, 11, 4, 29] are not in general minimum variance linear unbiased under one-level rotation sampling. A missing value approach is employed to derive estimates of the level and the change under the general assumptions of nonnormality and unknown covariance matrix. Asymptotic behavior of these estimates is investigated. In addition a two-stage design with complete rotation of psu's and ssu's is introduced. Minimum variance linear unbiased estimates of the level and the change are derived under the assumptions of known variances and covariances. Asymptotic properties of the estimates, derived under the assumptions of unknown variances and covariances, are studied. Dissert. Abstr.

N77-23837 Princeton Univ., N. J.
BOUNDS ON TRANSFER PRINCIPLES FOR ALGEBRAICALLY CLOSED AND COMPLETE DISCRETELY VALUED FIELDS Ph.D. Thesis
Scott Shorey Brown 1976 165 p
Avail: Univ. Microfilms Order No. 77-4779

The following bounds for well known transfer principles were established. Theorem 1: If S is a first order statement in the language with plus, minus, times, and constant symbols 0, 1, 10, 11, 100,... whose representation is m characters long and p > 2**2**2**(3m) then S holds in the theory of algebraically closed fields of characteristic p. Theorem 2: If S is a statement of length m in the language of theorem 1 along with a constant symbol which represents a uniformizing parameter and p > 2**2**2**2**2**2**11**m then S holds in the p-adic field Qp. Theorem 3: For every natural number d any form of degree d in more than d**2 variables has a nontrivial zero in Qp provided p > 2**2**2**2**2**2**11**d**(4d). In each case, the bound is established by showing how the statement's quantifiers may be replaced by quantifiers which range over finite sets of algebraic numbers. Dissert. Abstr.

N77-23838 California Univ., Berkeley.
AN EXTENSION OF DUALITY-STABILITY RELATIONS TO NONCONVEX OPTIMIZATION PROBLEMS Ph.D. Thesis
Erik Jan Balder 1976 47 p
Avail: Univ. Microfilms Order No. 77-4369

By an effective extension of the conjugate function concept a general framework for duality-stability relations in nonconvex optimization problems is studied. The results obtained show strong

correspondences with the duality theory for convex minimization problems. A minimax theorem of a new kind is obtained. In specializations to mathematical programming problems the canonical Lagrangian of the model appears as the extended Lagrangians considered in exterior penalty function methods. These methods are therefore provided with a geometrically oriented, theoretical background. Some general convergence results are given. Especially for the so-called exact penalty function methods, the geometrical insight might be helpful, as is illustrated by some examples. Dissert. Abstr.

N77-23839 Massachusetts Univ., Amherst.
AFTEREFFECTS, ADAPTATION, AND PLASTICITY: A NEURAL MODEL FOR TUNABLE FEATURE SPACE Ph.D. Thesis
Fanya S. Montalvo 1976 107 p
Avail: Univ. Microfilms Order No. 77-6432

Techniques in computer image processing, such as feature extraction and histogram uniformization, are compared to the biological phenomenon of developmental plasticity and aftereffects. The types of transformations enabled by synaptic modification in neural networks are investigated with computer simulation. A self-organizing, feature-extracting network is extended to two feature dimensions to encompass line orientation and color. It is applied to McCollough effects, particularly long-lasting, contingent-aftereffects. McCollough effects are thought to involve low-level associative memory in the form of synaptic modification. The McCollough-Malsburg model embodies positive synaptic modification with correlated firing of units in an input layer and an excitatory cortical layer. Dissert. Abstr.

N77-23840 California Univ., Berkeley.
SOLUTION OF BOUNDARY-VALUE POTENTIAL PROBLEMS BY A FINITE ELEMENT METHOD WITH INVARIANT IMBEDDING Ph.D. Thesis
Hin Chiu 1976 96 p
Avail: Univ. Microfilms Order No. 77-4418

A computation scheme for solving the potential equation with mixed-type boundary conditions assigned at boundaries of arbitrary shape is presented. The method of solution for a real-valued or a complex-valued potential is discussed in some detail. Using a finite element approach, the problem was changed to finding the unknown potential by means of a set of algebraic equations. The application of the Riccati transformation in the finite element equations leads to a set of recurrence formulas that permit a conversion of the original boundary value problem into an initial value problem with the computation to be carried out in the forward direction. By invariant imbedding, the solution is obtained in a one-sweep sequential-computation procedure. Consequently, the computation ends up with a large cut-back in computer memory storage as well as computation time in comparison with conventional methods. Dissert. Abstr.

N77-23841# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
ALGORITHMS FOR THE SOLUTION OF THE NON-LINEAR LEAST-SQUARES PROBLEM
Philip E. Gill and Walter Murray Nov. 1976 41 p refs
(NPL-NAC-71) Avail: NTIS HC A03/MF A01

The algorithms are based upon modifying the Gauss-Newton method so that it converges when the Jacobian matrix is rank deficient and the sum of squares is not small near the solution. The algorithms have been implemented in FORTRAN. ESA

N77-23842# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
MINIMIZATION SUBJECT TO BOUNDS ON THE VARIABLES
Philip E. Gill and Walter Murray Dec. 1976 24 p refs
(NPL-NAC-72) Avail: NTIS HC A02/MF A01

In recent years a number of new algorithms based on matrix factorizations have been proposed for both unconstrained and linearly-constrained optimization. Similar algorithms are discussed for a special class of linearly-constrained problems in which the constraints are just simple bounds on the variables. It is shown that sufficient advantage can be taken of the special structure of the constraints to render separate unconstrained algorithms unnecessary. Author (ESA)

N77-23843# Florence Univ. (Italy). Facolta d'Ingegneria.
NONLINEAR BOUNDARY VALUE PROBLEMS FOR A CLASS OF HYPERBOLIC SYSTEMS
Viorel Barbu (Iasi Univ.) 1976 17 p refs Presented at the Seminary of the Ist. di Mat. Appl., Florence, 30 Apr. 1976
Avail: NTIS HC A02/MF A01

Several existence and uniqueness results are discussed for semilinear hyperbolic partial differential equations in two independent variables (time and one space dimension) with nonlinear boundary conditions. Two types of such problems, physically present in hydraulic pipelines and in transmission line theory, are presented. ESA

N77-23844# Florence Univ. (Italy). Facolta d'Ingegneria.
NONLINEAR BOUNDARY VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS: FROM SCHAUDER THEOREM TO STABLE HOMOTOPY
Jean Mawhin (Louvain Univ., Belg.) 1976 23 p refs Presented at the Seminary of the Ist. di Mat. Appl., Florence, 10 Feb. 1976
Avail: NTIS HC A02/MF A01

The interaction between topological methods and differential equations in the specific domain of nonlinear boundary value problems for ordinary differential equations is described. All the results are stated and proved for second order differential equations with bounded righthand sides, but similar results can be obtained by the same approach for higher-order differential equations with quasi-bounded righthand sides of sufficiently small quasinorm. ESA

N77-23845# Missouri Univ., Kansas City. Dept. of Mathematics.
ALGORITHMS FOR RATIONAL APPROXIMATIONS FOR A CONFLUENT HYPERGEOMETRIC FUNCTION II Interim Report
Yudell L. Luke 1 Sep. 1976 36 p refs
(Grant AF-AFOSR-2520-73)
(AD-A032910; AFOSR-76-1165TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

This is a sequel to a previous paper where rational approximations for the confluent hypergeometric function were treated. Here we take up rational approximations for (1)F(1)(a;c;-z). The confluent functions are very important in the applications since they include as special cases the incomplete gamma function Bessel functions, parabolic cylinder functions and Coulomb wave functions. In the special case where a is unity, the confluent function becomes an incomplete gamma function. In this event, complete a priori error analyses for the main diagonal Pade approximations and much more were presented. For general parameters, the rational approximations treated were not of the Pade class. It was shown that the rational approximations converge, but a complete a priori analysis was not available. One of the purposes of this report is to correct this deficiency. GRA

N77-23846# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SOLUTIONS OF CERTAIN MATRIX EQUATIONS WITH APPLICATIONS TO ENGINEERING SCIENCES M.S. Thesis
James L. Leuthauser Dec. 1976 108 p refs
(AD-A032667; GA/MA/76D-1) Avail: NTIS HC A06/MF A01 CSCL 12/1

Solutions of certain matrix equations are presented in this thesis. Results of Mitra are used to extend current methods of obtaining a general form of the solution of the Liapunov equation. Solutions of the general linear matrix equation, including important special cases, are obtained under rather general conditions on the matrices. Necessary and sufficient conditions are established for the existence of a solution of $AX = C$ where the elements of the matrices belong to the polynomial domain of the field of real numbers. Representations of solution to the algebraic Riccati equation are given along with original techniques for computation of solutions and conditions for uniqueness. Sufficient conditions for the existence of the generalized nonlinear algebraic and differential Riccati equations are established. The classical Newton-Raphson method of finding zeros of functions of a single variable is extended to the case of finding zeros of functions of

a matrix variable, including determining the inverse of a matrix. An extensive bibliography includes a comprehensive listing of articles which provide historical and developmental background on the matrix equations considered in this thesis. GRA

N77-23847# Wyoming Univ., Laramie. Dept. of Statistics.
PARALLEL AND INTERSECTING FLATS FRACTIONS: ESTIMABILITY AND ALIAS STRUCTURES
Donald A. Anderson and Ann M. Thomas Sep. 1976 50 p refs
(Contract N00014-75-C-0515)
(AD-A032791; S-1976-2017; RP-139) Avail: NTIS HC A03/MF A01 CSCL 12/1

Regular fractional factorial designs may be obtained as solutions sets to linear equations. It is well known how to determine which factorial effects are estimable, and how to construct the alias sets directly from the system matrix. There is no unified theory developed for determining estimability and alias structures from types of fractions involving intersecting flats. The purpose of this paper is to present some preliminary results in the development of such a theory. GRA

N77-23848# Wyoming Univ., Laramie. Dept. of Statistics.
RESOLUTION IV FRACTIONAL FACTORIAL DESIGNS FOR THE GENERAL ASYMMETRIC FACTORIAL
Donald A. Anderson and Ann M. Thomas Sep. 1976 37 p refs
(Contract N00014-75-C-0515)
(AD-A032821; S-1976-2018; RP-140) Avail: NTIS HC A03/MF A01 CSCL 12/1

Resolution IV fractional factorial designs permit estimates of all main effects in the presence of two factor interactions which may not be estimable. In this paper a method of construction is given which yields resolution IV designs near the theoretical (perhaps unattainable) lower bound. GRA

N77-23849# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
SOME RESULTS ON SUBSET SELECTION PROBLEMS
Yoon-Kwai Leong Dec. 1976 125 p refs
(Contract N00014-75-C-0455)
(AD-A033362; Mimeograph-Ser-475) Avail: NTIS HC A06/MF A01 CSCL 12/1

The main purpose of this paper is to propose and study the subset selection approach for some new problems. Chapter I deals with some subset selection procedures for Poisson populations. A procedure of the type discussed by Seal is proposed and compared with the main proposed procedure which is an unconditional rule. Some selection procedure for populations better than a standard are also investigated. In Chapter II, a subset selection procedure based on the sample median for selecting the largest of the k location parameters of double exponential (Laplace) distributions is studied. For this distribution the problem of selection for the scale parameters is also investigated. A test of homogeneity is proposed which is based on the range of sample medians. An indifference zone approach to the problem of selecting the populations with the t-largest unknown means is also studied. Chapter III discusses some classification rules for k univariate normal populations using the subset selection approach. The classification problem is studied in terms of: (I) the mean, (II) the variance, and (III) the reciprocal of the coefficient of variation. Chapter IV deals with a conditional and an unconditional procedure for selecting a subset which contains the negative binomial population with the smallest unknown probability of a success. Selection of populations better than a standard is also investigated. An application of the procedure to reliability theory is described. Author (GRA)

N77-23850# RAND Corp., Santa Monica, Calif.
CURVES: A COST ANALYSIS CURVE-FITTING PROGRAM Interim Report
H. E. Boren, Jr. and G. W. Corwin Sep. 1976 120 p Supersedes R-1753-PR
(Contract F44620-73-C-0011)
(AD-A032579; R-1753-1-PR) Avail: NTIS HC A06/MF A01 CSCL 12/1

This report describes a FORTRAN-IV curve-fitting computer program (CURVES) that makes least-squares determinations of the parameters of any of eight types of equations selected by the user, given a set of observations on the dependent and independent variables of interest. The types of equations that can be fitted are: linear, quadratic, power, asymptotic-power, exponential, logarithmic-linear, and two types of semilogarithmic-linear. Except for the quadratic and asymptotic-power equations, up to seven independent variables may be used. Y-intercepts may be specified for all equations except the power and exponential. GRA

N77-23851# Stanford Univ., Calif. Dept. of Computer Science.
INITIAL BOUNDARY VALUE PROBLEMS FOR INCOMPLETELY PARABOLIC SYSTEMS Ph.D. Thesis
John Charles Strikwerda Oct. 1976 116 p refs
(Contract N00014-75-C-1132)
(AD-A032802; SU-STAN-CS-76-565) Avail: NTIS HC A06/MF A01 CSCL 12/1

This thesis deals with initial boundary value problems for incompletely parabolic systems of partial differential equations. Such systems can be described as a second order Petrovskii parabolic system and a first order hyperbolic system coupled together by terms with first order spatial derivatives. The dependent variables are then of either parabolic or hyperbolic type. Examples are the equations for couple sound and heat flow and the viscous shallow water equations. GRA

N77-23852# Colorado State Univ., Fort Collins. Dept. of Mathematics.
APPROXIMATION WITH RECIPROCALS OF POLYNOMIALS ON COMPACT SETS Interim Report
D. J. Leeming and G. D. Taylor Aug. 1976 24 p refs
(Grant AF-AFOSR-2878-76)
(AD-A032909; AFOSR-76-1164TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A theory best uniform approximation by reciprocals of polynomials on compact sets is developed. In particular an existence theorem is shown to hold in this case. Author (GRA)

N77-23853# Kentucky Univ., Lexington. Dept. of Engineering Mechanics.
THE BOUNDARY INTEGRAL EQUATION METHOD USING VARIOUS APPROXIMATION TECHNIQUES FOR PROBLEMS GOVERNED BY LAPLACE'S EQUATION M.S. Thesis. Interim Report
Yen Sen Wu Dec. 1976 105 p refs
(Grant AF-AFOSR-2824-75; AF Proj. 9782)
(AD-A033891; AFOSR-76-1313TR) Avail: NTIS HC A06/MF A01 CSCL 12/1

The Boundary Integral Equation (BIE) method is applied to boundary value problems governed by Laplace's equation. In addition to the piecewise constant approximation for boundary functions, two other numerical approximations, quadratic shape function and cubic spline function representations, are adopted. Comparisons are discussed. Topics for further research are indicated. Author (GRA)

N77-23854# RDP, Inc., Waltham, Mass.
MATHEMATICAL AND NUMERICAL ANALYSIS IN SUPPORT OF SCIENTIFIC RESEARCH Final Report, 15 Nov. 1973 - 14 May 1976
Joseph P. Noonan, Richard W. Doherty, Isaac Fried, Thomas M. Costello, Barry Hass, Paul E. Meehan, Joseph F. Russell, Jr., Marcel Schneeberger, and Brendan J. Welch Hanscom AFB, Mass. AFGL 30 Jun. 1976 75 p
(Contract F19628-74-C-0124)
(AD-A034042; AFGL-TR-76-0179) Avail: NTIS HC A04/MF A01 CSCL 05/5

This report is presented to give a description of the mathematical and numerical analysis effort in support of the Air Force scientists engaged in basic research in the environmental sciences. The scope of problems reported both in the particular discipline supported and the type of support is quite broad. Typically, the analysis involved: mathematical modelling, digital filtering, integral evaluations, solving systems of differential equations (both ordinary and partial), data fitting, and Fourier analysis. Application computer programs were also developed to

not only check the analysis but also to produce data required by the scientists. GRA

N77-23855# Washington Univ., Seattle. Dept. of Mathematics.
ADJOINTS OF PROJECTIVE TRANSFORMATIONS AND FACE FIGURES OF CONVEX POLYTOPES
Victor Klee Dec. 1976 15 p refs
(Contracts N00014-67-A-0103-0003; N00014-76-C-0423; NR Proj. 044-353)
(AD-A033970; TR-59) Avail: NTIS HC A02/MF A01 CSCL 12/1

When F is a proper face of a (convex) polytope P in a Euclidean space E, an F-figure of P is an intersection of sets P and H where H is a hyperplane strictly separating F from all vertices of sets P and F (which have a one to one relation). Here it is shown how, when the origin is interior to P, the combinatorial (and, in a sense, the projective) structure of P's F-figures can be described in terms of the boundary structure of the polar polytope P superscript 0. The main tool is the notion of the adjoint of a projective transformation and a basic formula relating adjoints to polars. Author (GRA)

N77-23856# Cornell Univ., Ithaca, N.Y. School of Operations Research and Industrial Engineering.
THE EXISTENCE PROBLEM FOR SOLUTIONS
William F. Lucas Jun. 1976 20 p refs
(Contract N00014-75-C-0678; Grant NSF MPS-75-02024)
(AD-A033851; TR-298) Avail: NTIS HC A02/MF A01 CSCL 12/2

This paper discusses the current state of knowledge on the existence of Von Neumann-Morgenstern solutions (stable sets). Some alternate mathematical problems related to existence are described, and a couple of recently introduced solution concepts related to the classical model are mentioned. Author (GRA)

N77-23857# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
RESEARCH ON NONLINEAR DYNAMICAL SYSTEMS Final Technical Report, 1 Dec. 1975 - 31 Aug. 1976
E. F. Infante 19 Oct. 1976 15 p refs
(Grants DAHC04-75-G-0077; DAAG29-76-G-0052)
(AD-A034013; ARO-11497.48-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

The principal areas of research reported are: functional differential equations and their control; linear and nonlinear dynamical systems and their stability; bifurcation theory and applications to plates and shells; hyperbolic systems of conservation laws; stability of nuclear reactor models; and stability of elastic structures. This report briefly summarizes results and refers to specific publications and reports previously reported to the U.S. Army Research Office. GRA

N77-23858# Wisconsin Univ., Madison. Mathematics Research Center.
A NONLINEAR SINGULARLY PERTURBED VOLTERRA INTEGRODIFFERENTIAL EQUATION OCCURRING IN POLYMER RHEOLOGY Summary Report
A. S. Lodge, J. B. McLeod, and J. A. Nohel Nov. 1976 77 p refs
(Contract DAAG29-75-C-0024; Grant DAHC04-74-G-0012)
(AD-A034470; MRC-TSR-1694) Avail: NTIS HC A05/MF A01 CSCL 12/1

A study is presented on the initial value problem for the nonlinear volterra integrodifferential equation. This problem arises as a mathematical model for a process in polymer rheology which is described. GRA

N77-23859# Wisconsin Univ., Madison. Mathematics Research Center.
GENERALIZED GRADIENTS OF LIPSCHITZ FUNCTIONALS Summary Report
Frank H. Clarke Oct. 1976 33 p refs
(Contract DAAG29-75-C-0024)
(AD-A034474; MRC-TSR-1687) Avail: NTIS HC A03/MF A01 CSCL 12/2

The purpose of this article is threefold: (1) to present in a unified fashion the theory of generalized gradients, whose elements are at present scattered in various sources; (2) to give an account of the ways in which the theory has been applied; (3) to prove new results concerning generalized gradients of summation functionals, pointwise maxima, and integral functionals on subspaces of L(Infinity). GRA

N77-23860# Wisconsin Univ., Madison. Mathematics Research Center.
SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS BY MEANS OF FINITE ELEMENTS: AN INTRODUCTORY SKETCH
J. Barkley Rosser Dec. 1976 36 p refs
(Contract DAAG29-75-C-0024)
(AD-A034479; MRC-TSR-1705) Avail: NTIS HC A03/MF A01 CSCL 12/2

An introductory exposition is given covering the solution of some partial differential equations by means of the method of finite elements. Special attention is given to the means of getting numerical approximations to the answer. Author (GRA)

N77-23861# Boston Coll., Chestnut Hill, Mass. Mass Space Data Analysis Lab.
NUMERICAL AND DATA ANALYSIS TECHNIQUES APPLIED TO SCIENTIFIC RESEARCH, 2 Final Report, 1 Jan. 1973 - 31 Dec. 1975
Joseph E. Martine and Leo F. Power, Jr. 31 Mar. 1976 138 p refs
(Contract F19628-73-C-0136)
(AD-A034047; BC-SDAL-76-2; AFGL-TR-76-0091) Avail: NTIS HC A07/MF A01 CSCL 09/2

This report describes selected mathematical analysis, numerical analysis, and computer programming problems. Each problem selected is presented in capsule form and the analysis and computer techniques are outlined. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N77-23862 California Univ., Berkeley.
MINIMAX PROCEDURES AND CAPACITIES Ph.D. Thesis
Tadeusz Bednarski 1976 61 p
Avail: Univ. Microfilms Order No. 77-4374

Statistical properties of certain sets of probability measures are discussed. A statistical concept used is a finite experiment. In particular it is proved that a family of probability measures generated by a two-alternating capacity can be described in terms of the least informative binary experiments. A general method of construction of minimax tests for testing problems in which hypotheses are generated by two-alternating capacities is also discussed. Dissert. Abstr.

N77-23863 Oklahoma State Univ., Stillwater.
DETERMINATION OF SAMPLE SIZE FOR SPECIFIED WIDTH CONFIDENCE INTERVALS IN DIGITAL SIMULATION EXPERIMENTS Ph.D. Thesis
Belva Jones Cooley 1976 130 p
Avail: Univ. Microfilms Order No. 77-5058

A new method for computing sample size requirements for simulation experiments in which the data are autocorrelated and fit either exponential or geometric was empirically tested and found to be a valid procedure. In comparison to the Fishman procedure, the method was found to be more efficient in that it produced sample size requirements which were generally smaller than those required by Fishman. Dissert. Abstr.

N77-23864 Oklahoma State Univ., Stillwater.
CLOSED SEQUENTIAL PROCEDURES FOR TESTING HYPOTHESES ABOUT THE PARAMETER OF A RAYLEIGH DISTRIBUTION Ph.D. Thesis
James Edward Gibson 1976 135 p
Avail: Univ. Microfilms Order No. 77-5076

A detailed empirical investigation of the (open) sequential probability ratio test and several closed sequential tests of hypotheses about the parameter of Rayleigh distribution was

conducted using Monte Carlo simulation. Cases representing combinations of five different sets of Type I and Type II error rates and two different discrimination ratios were studied. The problem of adjusting the acceptance and rejection boundaries to give the specified error rates was given particular attention. Additionally, closed procedures were examined to determine effects of delaying accept or reject decisions until several observations have been taken and the effect of continuing the sequential precedure beyond the fixed-sample size n.
Dissert. Abstr.

N77-23865 Kansas State Univ., Manhattan.
COMPARISON OF THE W AND THE Z PROCEDURES IN COVARIATE DISCRIMINANT ANALYSIS Ph.D. Thesis
Robert Irvin McGee 1976 104 p
Avail: Univ. Microfilms Order No. 77-5515

Covariate discrimination procedures based on the W criterion defined by Cochran and Bliss (1948) and Cochran (1964) and the Z criterion defined by Memon (1968) and Fujikoshi and Kanazawa (1976) are compared with respect to total error rates of the procedures. To make an extensive comparison in the case of moderate sample sizes, the cubic terms are added to the asymptotic expansion formulae for the error rates of the W procedure given by Memon and Okamoto (1970), and the quadratic and cubic terms are added to the asymptotic expansion formulae for the error rates of the Z procedure given by Memon (1968) and Fujikoshi and Kanazawa (1976). Relations existing between two sets of coefficients in the expansion formulae for the error rates of the W procedure and the Z procedure are proved, and a basic formula for the numerical comparison is derived. Dissert. Abstr.

N77-23866 California Univ., Berkeley.
NONPARAMETRIC ESTIMATION OF PROBABILITY DENSITY FUNCTIONS USING ORTHOGONAL EXPANSIONS Ph.D. Thesis
Aldo Jose Viollaz 1976 129 p
Avail: Univ. Microfilms Order No. 77-4637

An asymptotic expression for the variance of the estimate was found, and its asymptotic distribution was Gaussian. These results apply to a large class of density estimates including estimates considered by Parzen (1962), Leadbetter (1963) with kernels with compact support and also those estimates derived from orthogonal expansions. Density estimates derived from trigonometric and Jacobi orthogonal expansions are studied. For f belonging to classes of functions defined in terms of the derivatives of f, explicit bounds were found for the mean square error of the estimates, holding uniformly over these classes. The rates of mean square consistency obtained with the best possible rates were compared. Dissert. Abstr.

N77-23867 Drexel Univ., Philadelphia, Pa.
DEVELOPMENT AND VALIDATION OF A NON-MARKOVIAN STOCHASTIC MODEL FOR THE TAICHUNG MEDICAL IUD EXPERIMENT Ph.D. Thesis
Gary Stephen Littman 1977 195 p
Avail: Univ. Microfilms Order No. 77-5229

A non-Markov stochastic model is developed and validated within the context of data from the Taichung Medical IUD Study. The principles of absorbing age-dependent semi-Markov processes are first set down, along with an algorithm to compute the sum of an infinite geometric series in Markovian matrix convolutions, a key task when dealing with these processes. Then, the available data is described, and an indication is given as to why a Markovian process is inappropriate for modeling the behavior reported in these data. Using semi-Markov processes to model particular portions of the reproductivity history, an overall non-Markovian model is developed with the viewpoint of a sequential decision process. In addition to reporting various calculations based on this model, empirical estimates of certain quantities are made and compared with corresponding values projected by the model, generally with good success. Dissert. Abstr.

N77-23868 New York Univ., N. Y.
DIOPHANTINE APPROXIMATION AND THE MARKOV CHAIN Ph.D. Thesis
Christopher Gurwood 1976 68 p
Avail: Univ. Microfilms Order No. 77-5407

If lambda is any positive number < 3, then for all but finitely irrational theta eta (0,1) there exists a rational number. However, there are uncountably many theta eta. The exceptional numbers theta which occur are related to Markov's minimal quadratic forms. All solutions to Markov's diophantine equation m squared + n squared + p squared = 3mnp can be generated from smaller solutions. The solutions form a branching chain known as the Markov chain. It is shown that there is a natural correspondence between the points of this chain and the rational numbers eta [0,1]. This correspondence is used to prove that the number of solutions (m,n,p) with 0 < p < N < m is asymptotic to c log squared N as N approaches infinity.
Dissert. Abstr.

N77-23869 Cornell Univ., Ithaca, N.Y.
ENTRANCE LAWS FOR MARKOV CHAINS AND ONE-DIMENSIONAL DIFFUSIONS Ph.D. Thesis
John Theodore Cox 1976 95 p
Avail: Univ. Microfilms Order No. 77-5737

Let S be a countable set and Q a stochastic matrix on SxS. An entrance law can be used to construct a Markov chain xi sub n with stationary transition probabilities Q which is defined for all integer times n, positive and negative. Conversely, such a Markov chain gives rise to an entrance law. It is shown that the set of all entrance laws for Q is convex and is completely determined by its extreme points. Several limit theorems are proved using direct probabilistic arguments. It is shown that entrance laws are connected in an intimate way with the convergence of certain hitting times. These results have application to the extended chain xi sub n. Analogous problems for continuous time Markov chains are considered and solved by reduction to the discrete time case. A more complete result is obtained for birth and death processes about the hitting time characterization of entrance laws. Analogous problems for one-dimensional diffusions are also examined. Results similar to those for birth and death processes are obtained. Dissert. Abstr.

N77-23870 New York Univ., N. Y.
A DEVELOPMENT OF THE THEORY AND APPLICATION OF BAYESIAN DECISION THEORY Ph.D. Thesis
Allan John Ceasar 1976 215 p
Avail: Univ. Microfilms Order No. 77-5289

The important theoretical components of the Bayesian model were investigated. The set of actions which are available to the decision maker, the states of nature which are factors outside of his control, the consequences that would result from each action and each state, and the utility (preference) measure of each of the consequences are included. Probability assessments of the respective states of nature deduced from prior information and sample information are also included. Bayes theorem is utilized as the formal mechanism to combine this information to form the posterior information. Finally, expected value is introduced as the appropriate decision criterion in Bayesian decision theory. Dissert. Abstr.

N77-23871 New York Univ., N. Y.
FAST POISSON SOLVER ON NONRECTANGULAR DOMAINS Ph.D. Thesis
Arthur Shan-Luk Shieh 1976 114 p
Avail: Univ. Microfilms Order No. 77-5465

An analytical study of the efficiency of a fast Poisson solver on an arbitrary nonrectangular domain omega with smooth boundary is discussed. It concerns a procedure of solving the linear algebraic equations arising from finite difference discretization of Neumann and Dirichlet problems of Poisson's equation efficiently by the capacitance matrix method. This algorithm exploits the efficiency of the fast Poisson solvers on simple regions and the well-posedness of the Fredholm integral equations of the second kind. It is shown analytically that for a large class of nonrectangular domains the operation counts of this algorithm for achieving a given accuracy are proportional to N.log N where N is the number of mesh points inside the region omega. Dissert. Abstr.

N77-23872# Oregon Research Inst., Eugene.
APPLICATIONS OF LINEAR MODELS TO PROBLEMS OF PREFERENCE AND PREDICTION
Robyn M. Dawes and Bernard Corrigan Sep. 1976 39 p refs

Prepared for Decisions and Designs, Inc., McLean, Va.
(Contract N00014-76-C-0074)
(AD-A033094) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report describes two separate studies that apply linear models to problems of preference and prediction. Report 1 is entitled 'Predictive Models as a Guide to Preference.' Report 2 is entitled 'A Unit Weighted Model for Prediction and Discrimination.' Separate summaries are given prior to each individual report. Author (GRA)

N77-23873# North Carolina Univ., Chapel Hill. Dept. of Statistics.

ON THE REPRESENTATION OF NONLINEAR SYSTEMS WITH GAUSSIAN INPUTS Interim Report

Steel T. Huang (Cincinnati Univ.) and Stamatis Cambanis 1976 10 p refs
(Grant AF-AFOSR-2796-75)
(AD-A032911; AFOSR-76-1198TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

An arbitrary nonlinear system with input a Gaussian process, which is such that its output process has finite second moments, admits two kinds of representations; the first in terms of a sequence of deterministic kernels and the second in terms of a single stochastic kernel. We consider here the identification of the sequence of deterministic kernels from the input and output processes, the representation of the system output when its input is a sample function of the Gaussian process, and the relationship of the sequence of kernels mentioned above to the Volterra expansion kernels when the system has a Volterra representation. Author (GRA)

N77-23874# Purdue Univ., Lafayette, Ind. Dept. of Statistics.

CHI-SQUARE TESTS Interim Report

David S. Moore 1976 53 p refs Submitted for publication
(Grant AF-AFOSR-2350-72; AF Proj. 2304)
(AD-A033287; Mimeograph-Ser-469; AFOSR-76-1227TR)
Avail: NTIS HC A04/MF A01 CSCL 12/1

This report is an exposition of chi-square tests in the context of modern large-sample theory. The paper provides some historical and practical motivation and necessary background on large-sample methods and especially on multivariate normal random variables and their quadratic forms. There follows a unified exposition of the distribution of general chi-square statistics and of construction of statistics having a specified and limiting null distribution. Author (GRA)

N77-23875# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.

I, II: CONVERGENCE AND RATE OF CONVERGENCE THEOREMS FOR CONSTRAINED AND UNCONSTRAINED STOCHASTIC APPROXIMATION, VIA WEEK CONVERGENCE METHODS. III: NUMERICAL STUDIES FOR CONSTRAINED STOCHASTIC APPROXIMATION

Harold J. Kushner and S. Lakshmivarahan Aug. 1976 140 p refs
(Contract N00014-76-C-0279; Grant AF-AFOSR-2078-71)
(AD-A032824; LCDS-TR-76-1) Avail: NTIS HC A07/MF A01 CSCL 12/1

This report contains 3 papers. The first two deal with applications of the theory of weak convergence to general results in constrained and unconstrained stochastic approximation. The third paper gives an extensive discussion of the numerical properties of four algorithms for the constrained case. GRA

N77-23876# Syracuse Univ., N. Y.

SOME FURTHER CONSIDERATIONS ON THE ESTIMATION OF ERROR OF MISCLASSIFICATION BASED ON THE DESIGN SET Technical Report, Jun. 1975 - Jun. 1976

Kishan Mehrotra Oct. 1976 53 p refs
(Contract F30602-75-C-0121)
(AD-A033717; RADC-TR-76-322) Avail: NTIS HC A04/MF A01 CSCL 12/1

Estimates of the variance of the estimated probability of error for linear classifiers under normal distributions are calculated as related to dimensionality and the number of features. Author (GRA)

N77-23877# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.

APPROXIMATIONS FOR FUNCTIONALS AND OPTIMAL CONTROL PROBLEMS ON JUMP DIFFUSION PROCESSES

Harold J. Kushner and Giovanni DiMasi Nov. 1976 61 p refs
(Contract N00014-76-C-0279; Grant AF-AFOSR-3063-76; NSF ENG-73-03846-A01)
(AD-A034911; LCDS-TR-76-2; AFOSR-77-0018TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

The paper treats approximations to stochastic differential equations with both a diffusion and a jump component, and to associated functionals and partial-differential-integral equations of the (degenerate or not) elliptic or parabolic type. Approximations for the optimal control problem on such a model, or for the associated non-linear partial-differential-integral equation, are discussed. The techniques are purely probabilistic and are extensions of those in another paper by the first author, which dealt with the diffusion case. GRA

N77-23878# Wisconsin Univ., Madison. Mathematics Research Center.

SIMPLIFIED POINT AND INTERVAL ESTIMATION FOR REMOVAL TRAPPING

Andrew P. Soms Dec. 1976 22 p refs
(Contract DAAG29-76-C-0024)
(AD-A034476; MRC-TSR-1704) Avail: NTIS HC A02/MF A01 CSCL 12/1

Two methods, the generalized moment, and the regression, both based on the limiting distribution of the multinomial are given for estimating the parameters in the removal trapping method of estimating animal and insect populations. Some finite sample size results are provided indicating the speed of convergence to the limiting distribution. Numerical examples are also discussed. Author (GRA)

N77-23879# Naval Underwater Systems Center, New London, Conn.

PROBABILITY DISTRIBUTION OF SPECTRAL ESTIMATES OBTAINED VIA OVERLAPPED FFT PROCESSING OF WINDOWED DATA

Albert H. Nuttall 3 Dec. 1976 49 p refs
(AD-A034753; NUSC-TR-5529) Avail: NTIS HC A03/MF A01 CSCL 17/2

The characteristic function of spectral estimates obtained via overlapped FFT processing of windowed data is presented for a random process containing a signal tone and Gaussian noise. For the special case of noise-alone, the probability distribution of the estimate is plotted and compared with an approximation utilizing only the first two moments and found to be in excellent agreement in probability over the range (.0001, .9999) for several data windows, overlaps, and time-bandwidth products. This result means that knowledge of the equivalent degrees of freedom of the spectral estimate is adequate for a complete probabilistic description, even when the overlap results in significant statistical dependence of the component FFT outputs. Author (GRA)

N77-23880# Air Force Academy, Colo. Frank J. Seiler Research Lab.

ADAPTIVE ESTIMATION OF DOUBLY STOCHASTIC POISSON PROCESSES WITH APPLICATION TO ADAPTIVE OPTICS

Robert B. Asher and Demetrios G. Lainiotis Oct. 1976 28 p refs
(AF Proj. 2304)
(AD-A033399; SRL-TR-76-0016) Avail: NTIS HC A03/MF A01 CSCL 20/6

The optimal adaptive estimator structures for a class of doubly stochastic Poisson processes (DSPP) are presented. The structure is used along with a moment assumption to obtain implementable estimators. The class of DSPP considered is that of a linear Markov diffusion process modulating a linear intensity rate. The uncertainty for which the adaptation process is developed includes both structure uncertainty in the Markov diffusion process, and parameter uncertainty in the Markov diffusion process and the intensity rate process. Results are given on the problem of

adaptation of which of a finite number of Markov realizations is modulating the intensity process. The nonlinear adaptive estimator structures are obtained by use of a particular theorem that yields an optimal structure for the adaptive estimator. The structure is used to obtain a quasi-optimal adaptive estimator for the problem by use of a zero third central moment assumption. The estimator structure consists of a nonlinear, nonadaptive part, and a nonlinear, adaptive part which contains the parameter structure adaptations. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N77-23881 Wetenschappelijk en Technisch Documentatie- en Informatiecentrum voor de Krijgsmacht, The Hague (Netherlands).
RESEARCH AND DEVELOPMENT OF AIR- AND SPACE-RELATED PROJECTS UP TO THE YEAR 2000 AND THE IMPACT ON POSSIBLE MILITARY APPLICATIONS. A BIBLIOGRAPHY OF ABSTRACTS, JANUARY 1971 - SEPTEMBER 1976
H. J. Bos, comp. Oct. 1976 90 p refs Partly in DUTCH, FRENCH, GERMAN, and ENGLISH
(TDCK-68255) Avail: NTIS HC A05/MF A01

Abstracts of R & D projects in the broad aerospace and aeronautics fields having some military application during the period 1971-1976 and forming part of Project 2000 - a NATO-AGARD study on long-range forecasting of military needs for the defense of NATO-countries up to the year 2000 - are presented. ESA

N77-23882# Stanford Univ., Calif. Dept. of Computer Science.
THE STATIONARY P-TREE FOREST
Arne Jonassen Oct. 1976 93 p refs
(Contract N00014-76-C-0330; Grant NSF MCS-72-03752)
(AD-A032945; STAN-CS-76-573) Avail: NTIS HC A05/MF A01 CSCL 12/2

This paper contains a theoretical analysis of the conditions of a priority queue strategy after an infinite number of alternating insert/remove steps. Expected insertion time, expected length, etc. are found. Author (GRA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N77-23883 Cornell Univ., Ithaca, N.Y.
THE THEORY OF RECURSIVELY PRESENTED MODELS Ph.D. Thesis
Terrence Staples Millar 1976 96 p
Avail: Univ. Microfilms Order No. 77-5745

The extent to which some principal model theoretic constructions can be made effective was determined. The principal contribution of the work is the mixing of recursion theoretic methods with model theory. Several theorems are presented. Dissert. Abstr.

N77-23884 California Univ., Berkeley.
INVARIANT DESCRIPTIVE SET THEORY AND THE TOPOLOGICAL APPROACH TO MODEL THEORY Ph.D. Thesis
Douglas Edward Miller 1976 138 p
Avail: Univ. Microfilms Order No. 77-4539

Various types of topological spaces were studied with equivalence relations (Topological equivalence space) which arise in connection with model theory, and topological results and methods are applied to the study of languages and structures. Most of the model theoretic applications derive from consideration of the natural topological space formed by the set of countable structures of any fixed countable similarity type. Given a similarity type rho, for illustration consisting of a single binary relation, the structure (omega, R) with the charactersitic function of R and form the usual topological product space X sub rho = 2 to the (omega x omega) power is identified. Polish actions and spaces (X, G, J) are considered such that G is a nonmeager topological group with a countable basis, X is a topological space, and J: G x X approaches X is a Borel map which defines an action of G on X. Dissert. Abstr.

N77-23885 Princeton Univ., N. J.
MODULI SPACES OF COMPLEX VECTOR BUNDLES Ph.D. Thesis
Vern Alan Norton 1976 94 p
Avail: Univ. Microfilms Order No. 77-4794

Let X be a compact complex manifold of dimension m, and let H denote the cohomology set, parameterizing rank r vector bundles on X. The set H had a natural topology, and the extent to which H admits the structure of an analytic space was examined. The topological separation in H was considered, and sufficient conditions were given for two points of H to be separated. A method was given for showing pairs of bundles in H to be nonseparated, in particular providing necessary and sufficient conditions for nonseparation in the case m = 1, r = 2. The subset of H consisting of simple bundles was shown to admit the structure of a non-Hausdorff analytic space. This is used in particular to show that simple bundles on X admit universal deformations. In the case that X is projective algebraic, a definition of stable bundle was provided, extending Mumford's definition on curves. This definition was shown to provide a complex analytic Hausdorff moduli space, independent of the rank r or dimension m. Dissert. Abstr.

N77-23886 California Univ., Berkeley.
QUESTIONS IN DESCRIPTIVE SET-THEORY AND THE DETERMINACY OF INFINITE GAMES Ph.D. Thesis
Ramiz Labib Sami 1976 72 p
Avail: Univ. Microfilms Order No. 77-4589

The three categories of questions in descriptive set theory were studied. Some independence results for the reduction and separation properties for analytical classes were proved. The behavior of other models was investigated. The connection between determinacy and Turing determinacy is studied. Dissert. Abstr.

N77-23887 California Univ., Santa Barbara.
THE CONSTRUCTION OF DEFINITE INDECOMPOSABLE HERMITIAN FORMS Ph.D. Thesis
Richard Frederick Smith 1976 77 p
Avail: Univ. Microfilms Order No. 77-4879

Since every definite Hermitian lattice over the integers O of an algebraic number field E splits uniquely as the orthogonal sum of indecomposable sublattices, it is of interest to establish the existence of indecomposable lattices with prescribed invariants. Suppose E is a totally imaginary quadratic extension of a totally real algebraic number field F, and let n and d be natural numbers. By adapting the methods of O-Meara's paper to the Hermitian setting, the existence of a positive definite integral indecomposable Hermitian O-lattice of rank n and volume dO is established if E has ideal class number 1 and d is a totally positive integer of F that is divisible by the norm of a nonunit of O. It is shown that, if E has class number 1, then any two classes of positive definite unimodular Hermitian O-lattices can be connected by a chain of successive p-neighbors. Dissert. Abstr.

N77-23888 Princeton Univ., N. J.
WIENER PATH INTERSECTIONS AND EUCLIDEAN FIELD THEORY Ph.D. Thesis
Robert Lee Wolpert 1976 57 p
Avail: Univ. Microfilms Order No. 77-4807

Intersection properties of Wiener processes in the plane are investigated. For each positive integer k it is shown that k independent Wiener processes intersect almost surely in a set of Hausdorff dimension two, and that the set of points a single process visits at least k distinct times also has dimension two. A functional is constructed on configurations of k independent Wiener processes which measures the extent to which the trajectories of the k processes intersect. Certain L sup P estimates for this functional are proved and used in the construction of

the (phi sup k) sub 2 model of interacting Euclidean field theory. Dissert. Abstr.

N77-23889 New York Univ., N. Y.
CONTINUITY OF THE DIRECT AND INVERSE PROBLEMS IN ONE-DIMENSIONAL SCATTERING THEORY AND NUMERICAL SOLUTION OF THE INVERSE PROBLEM Ph.D. Thesis
Carlos Antonio DeMoura 1976 64 p
Avail: Univ. Microfilms Order No. 77-5385

The one-dimensional scattering problem is to relate the potential q in the operator to the so-called scattering data associated with E. It is known that to a certain class of potentials there corresponds a certain class of scattering data, and conversely. The sense in which this correspondence and its inverse are continuous was investigated for numerical or experimental approaches to these problems. Appropriate topologies in certain classes of potentials and of scattering data were determined and used to prove continuity results for both the direct and inverse mappings. An algorithm for the reconstruction of a potential from its corresponding reflection coefficient is described and compared to reconstructing the potential by numerically solving the Marchenko integral equations. Dissert. Abstr.

N77-23890 Connecticut Univ., Storrs.
THE ISOMORPHISM PROBLEM FOR INFINITE ABELIAN GROUP RINGS Ph.D. Thesis
Donna Lee Beers 1976 71 p
Avail: Univ. Microfilms Order No. 77-4249

If R is a commutative ring with identity and G and H are Abelian groups, the group algebras for G and H over R can be formed. Positive results are obtained if G and H are finite p-groups and R is a field of characteristic p, if G and H are finite and R is the field of rational numbers, Q, and if G and H are countable Abelian p-groups and R is a field of characteristic p. This problem is investigated when G and H are p-adic algebraically compact groups and R is a ring in which p is not invertible, and it is shown that the isomorphism problem is solvable in this case. The proof involves topologizing RG, investigating this topology, and showing that the isomorphism is continuous with respect to this topology. Dissert. Abstr.

N77-23891# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
SINGULAR PERTURBATIONS OF BIFURCATIONS
Bernard J. Matkowsky (Rensselaer Polytechnic Inst.) and Edward L. Reiss 1976 59 p refs
(Contract N00014-76-C-0010; Grants AF-AFOSR-2107-71; DAAG29-76-G-0253; NSF MPS-75-08328; NSF MCS-75-07868)
(AD-A033999; AFOSR-76-1307TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

An asymptotic theory is presented to analyze perturbations of bifurcations of the solutions of nonlinear problems. The perturbations may result from imperfections, impurities or other inhomogeneities in the corresponding physical problem. It is shown that for a wide class of problems the perturbations are singular. The method of matched asymptotic expansions is used to obtain asymptotic expansions of the solutions. Global representations of the solutions of the perturbed problem are obtained when the bifurcation solutions are known globally. This procedure also gives a quantitative method for analyzing singularities of nonlinear mappings and their unfoldings. Applications are given to a simple elasticity problem, and to nonlinear boundary value problems.
Author (GRA)

N77-23892# Cornell Univ., Ithaca, N.Y. School of Operations Research and Industrial Engineering.
DISCONNECTED SOLUTIONS
William F. Lucas Jan. 1976 9 p refs
(Contract N00014-75-C-0678; Grant NSF MPS-75-02024)
(AD-A033705; TR-281) Avail: NTIS HC A02/MF A01 CSCL 12/2

This report describes a twelve-person cooperative game in characteristic function form (with side payments) for which the union of all solutions (stable sets) is a disconnected set. This disproves a longstanding conjecture in the classical theory of coalitional games. Author (GRA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N77-23893 Missouri Univ., Rolla.
DETERMINATION OF VAPOR-LIQUID EQUILIBRIA FROM TOTAL PRESSURE MEASUREMENTS Ph.D. Thesis
Jose Antonio Martinez-Ortiz 1976 118 p
Avail: Univ. Microfilms Order No. 77-5556

The numerical solution of the relative volatility form of the isothermal Gibbs-Duhem equation is carried out by a relaxation technique for four diverse highly non-ideal binary systems and for two ternary systems at five different temperatures. The method calculates multicomponent vapor-liquid equilibrium, eliminates the necessity of approximating the excess Gibbs free energy with arbitrary empirical or semiempirical correlations, and also precludes the selection of suitable standard states. Vapor pressures for the ternary system isobutane-siobutylene-n-butane were experimentally determined over fifteen different compositions at temperatures from 40 deg to 160 deg F and pressure from 20 to 160 psia with a differential pressure transducer cell. They have an estimated average accuracy of 0.04 percent. The component data compared favorably with experimental values.
Dissert. Abstr.

N77-23894*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JPL BASIC RESEARCH REVIEW
17 Mar. 1977 114 p refs
(Contract NAS7-100)
(NASA-CR-152689; JPL-Publ-77-5) Avail: NTIS HC A06/MF A01 CSCL 05B

Current status, projected goals, and results of 49 research and advanced development programs at the Jet Propulsion Laboratory are reported in abstract form. Areas of investigation include: aerodynamics and fluid mechanics, applied mathematics and computer sciences, environment protection, materials science, propulsion, electric and solar power, guidance and navigation, communication and information sciences, general physics, and chemistry. Author

N77-23895# Danish Research Center for Applied Electronics, Hoersholm.
HIGH EMISSIVITY COATINGS FOR IR-TEMPERATURE MEASUREMENTS
E. Sletten [1976] 36 p refs
(ECN-15) Avail: NTIS HC A03/MF A01

Experiments with infrared temperature measurements on thickfilm resistors and conductors coated with the above mentioned polyurethane varnish are described. For temperature measurements on thickfilm circuits, the requirement was that the temperature variation due to variations in the emissivity was smaller than 0.5 C, which implies that the emissivity variation should be smaller than 1 percent. Author

N77-23896# Naval Ship Research and Development Center, Bethesda, Md.
ANALYTICAL METHODS FOR DETERMINING THE MOTION OF A RIGID BODY EQUIPPED WITH INTERNAL MOTION-SENSING TRANSDUCERS Final Report
Michael F. Jeffers, Jr. Oct. 1976 42 p refs
(AD-A033365; DTNSRDC-76-0041) Avail: NTIS HC A03/MF A01 CSCL 14/2

Analytical expressions are developed which relate the translational and angular accelerations, velocities, and displacements of a body with the outputs of six correctly placed internal motion-sensing transducers. These expressions are in a form that is easily converted into computer programs for analysis of data taken by motion-sensing transducers in any sort of free vehicle. Thus, they are appropriate for use in experimental studies in which the motion of torpedoes, missiles, etc. is to be measured.
Author (GRA)

N77-23897# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
A SIMULATION OF THE FLUCTUATIONS OF INTERNATIONAL ATOMIC TIME

James A. Barnes Nov. 1976 27 p refs
(PB-263104/2; NBS-TN-689) Avail: NTIS HC A03/MF A01 CSCL 14B

Estimates of noise levels which model the fluctuations in the International Atomic Time Scale (TAI) were used to construct an Auto Regressive, Integrated, Moving Average (ARIMA) model. The resulting ARIMA mathematical model, which can simulate time fluctuations in TAI, is given. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N77-23898*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EXPERIMENTAL DETERMINATION OF SOUND AND HIGH-SPEED FLOW INTERACTION

Edward Lumsdaine (Tenn. Univ., Knoxville) and Richard Silcox [1976] 9 p refs
(NASA-TM-X-74688) Avail: NTIS HC A02/MF A01 CSCL 20A

A facility that was used to measure the interaction of flow with sound at high Mach numbers is described. Four inlets with different area variations (or axial gradients) were tested. Sound of selected frequencies and modes (0,0), (1,0), (2,0) was generated with eight circumferential acoustic drivers. Author

N77-23899*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

SOME FACTORS INFLUENCING RADIATION OF SOUND FROM FLOW INTERACTION WITH EDGES OF FINITE SURFACES Technical Report, 1973 - 1976

R. E. Hayden, H. L. Fox, and R. C. Chanaud 1976 106 p refs
(Contract NAS1-9559)
(NASA-CR-145073; BN-2797) Avail: NTIS HC A06/MF A01 CSCL 20A

Edges of surfaces which are exposed to unsteady flow cause both strictly acoustic effects and hydrodynamic effects, in the form of generation of new hydrodynamic sources in the immediate vicinity of the edge. An analytical model is presented which develops the explicit sound-generation role of the velocity and Mach number of the eddy convection past the edge, and the importance of relative scale lengths of the turbulence, as well as the relative intensity of pressure fluctuations. The Mach number (velocity) effects show that the important paramater is the convection Mach number of the eddies. The effects of turbulence scale lengths, isotropy, and spatial density (separation) are shown to be important in determining the level and spectrum of edge sound radiated for the edge dipole mechanism. Experimental data is presented which provides support for the dipole edge noise model in terms of Mach number (velocity) scaling, parametric dependence on flow field parameter, directivity, and edge diffraction effects. Author

N77-23900# Purdue Univ., Lafayette, Ind. Ray W. Herrick Labs.

PROCEEDINGS OF THE EPA-UNIVERSITY NOISE SEMINAR

Joseph W. Sullivan, ed. and Andrew F. Seybert, ed. Oct. 1976 199 p refs Conf. held at Lafayette, Ind., 18-20 Oct. 1976 Sponsored by EPA
(EPA-550/9-77-300) Avail: NTIS HC A09/MF A01

The nature, scope, and results of research, development, and demonstration projects in all areas of noise control except aircraft noise are described in 23 reports from principal investigators in active research at universities. Emphasis is placed on noise-producing equipment; programs sponsored by industries are given priority. Projects sponsored by the government over the past three years are listed in the appendix. Author

N77-23901# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.

GEOMETRICAL ACOUSTICS TECHNIQUES IN FAR FIELD INFRASONIC WAVEFORM SYNTHESIS

A. D. Pierce and W. A. Kinney Mar. 1976 69 p refs
(Contract F19628-74-C-0065)
(AD-A024721; AFGL-TR-76-0055; Rept-2) Avail: NTIS HC A04/MF A01 CSCL 20/1

A ray acoustic computational model for the prediction of long range infrasound propagation in the atmosphere is described. A cubic spline technique is used to approximate the sound speed versus height profile when values of sound speed are input for discrete height intervals. Techniques for finding ray paths, travel times, ray turning points, and rays connecting source and receiver are described. A parameter characterizing the spreading of adjacent rays (or ray tube area) is defined, and methods for its computation are given. A method of determining the number of times a given ray touches a caustic is also described. Formulas are given for the computation of acoustic amplitudes and waveforms which involve a superposition of contributions from individual rays connecting source and receiver and which incorporate phase shifts at caustics. GRA

N77-23902*# National Bureau of Standards, Washington, D. C.

IMPROVED ULTRASONIC STANDARD REFERENCE BLOCKS Final Report

G. F. Sushinsky, D. G. Eitzen, D. J. Chwirut, C. J. Bechtoldt, and A. W. Ruff Nov. 1976 129 p refs Sponsored in part by NASA and Army Materials and Mechanics Research Center
(Contract F33615-74-M-6752)
(NASA-CR-152834; PB-262020/1; NBSIR-76-984) Avail: NTIS HC A07/MF A01 CSCL 14B

Techniques for residual stress, preferred orientation, and microstructural measurements were refined and applied to reference blocks rejected by manufacturers during fabrication in order to evaluate the effect of metallurgical condition on block response. The effects of certain dimensional variables on block response were studied and new fabrication techniques considered. A study of the effects of measurement system variables on block response was carried out. GRA

N77-23903# Army Construction Engineering Research Lab., Champaign, Ill.

THE STATISTICS OF AMPLITUDE AND SPECTRUM OF BLASTS PROPAGATED IN THE ATMOSPHERE. VOLUME 2: APPENDICES C THROUGH E Final Report

P. D. Schomer, R. J. Goff, and L. M. Little Nov. 1976 763 p
(DA Proj. 4A1-62121-A-896)
(AD-A033361) Avail: NTIS HC A99/MF A01 CSCL 13/2

This volume presents the spectra data derived from the analysis of the blast noise and meteorological measurements taken at Fort Leonard Wood, MO, and described in Volume I. One-third octave spectra, absolute, relative, and difference energy-average one-third octave spectra, and difference distributions are presented. Author (GRA)

N77-23904# Texas Univ., Austin. Applied Research Lab.

DISCRETE, CONTINUOUS, AND VIRTUAL MODES IN UNDERWATER SOUND PROPAGATION

A. O. Williams, Jr. (Brown Univ., Providence, R. I.) 26 Aug. 1976 51 p refs
(Contract N00039-76-C-0081)
(AD-A033084; ARL-TR-76-40) Avail: NTIS HC A04/MF A01 CSCL 20/1

Adopting two physical postulates and using only the language of eigenfunctions and eigenvalues, the author expresses the underwater sound field of a harmonic point source as a sum over orthonormal discrete modes plus an integral over a continuous set of normal modes. Restrictions are constant water depth, no absorption, parameters varying only with depth, and bottom material treated as a fluid. For the Pekeris case, orthogonality of the continuous modes is demonstrated, and the integral over continuous modes is proved identical to the branch line integral (BLI) of Ewing, Jardetzky, and Press. It is shown that farfield contributions to BLI are practically negligible except for contributions from narrow 'spikes' or resonances of the integrand. Conditions for existence of resonances are stated. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N77-23905 California Univ., Berkeley.
LITHIUM REACTIONS: RELATIVE ANGULAR AND SPEED CROSS SECTIONS FROM CROSSED BEAM COLLISIONS Ph.D. Thesis
Charlotte Marie Sholeen 1976 303 p
Avail: Univ. Microfilms Order No. 77-4600

A new crossed beam technique was developed which combines magnetic deflection and velocity analysis to look at the products from reactions of lithium atoms with halogen containing molecules. An inhomogeneous magnetic field deflected by the nonreacted species before a hot tungsten surface was used to ionize undeflected product species. This detection method in combination with velocity analysis of the products at a wide range of scattering angles determined the dependence of the cross section on recoil angle and speed for a number of Li reactions. This technique was used to study the reactions of Li with No2, Cl2, Br2, ICl, CH3I, CH3NO2, (CH)2CHNO2, CCl4, SnCl4, PCl3, and SF6. Dissert. Abstr.

N77-23906*# Teledyne Brown Engineering, Huntsville, Ala.
PROTON-INDUCED RADIOACTIVITY IN NaI (Tl) SCINTILLATION DETECTORS Interim Report
G. J. Fishman Apr. 1977 69 p refs
(Contract NAS8-26342)
(NASA-CR-150237) Avail: NTIS HC A04/MF A01 CSCL 18H

Radioactivity induced by protons in sodium iodide scintillation crystals were calculated and directly measured. These data are useful in determining trapped radiation and cosmic-ray induced, background-counting rates in spaceborne detectors. Author

N77-23907# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
A HYPERSONIC ATOMIC OXYGEN MOLECULAR BEAM SOURCE
Calvin K. Lam Dec. 1976 127 p refs
(UTIAS-212; CN-ISSN-0082-5255) Avail: NTIS HC A07/MF A01

A high intensity, high velocity atomic oxygen molecular beam source was developed, and its operating characteristics theoretically and experimentally investigated. The source operation is based on thermal dissociation in a thorium dioxide oven, and excellent source life-time and operating stability to 3000 K have been demonstrated, utilizing ohmic heating at 350 watts and multi-foil radiation shielding. Performance over a wide pressure range of He/O2 mixtures was investigated. The helium dilutions favor oxygen dissociation through its lower partial pressure, while maintaining high freezing Mach numbers in the beam formation process. It was demonstrated that the oxygen behavior in the source was unaffected by the presence of the helium. A best atomic oxygen beam intensity of 1.61 x 1018 atoms/steradian sec. from the source was attained at an estimated velocity of 3.8 km/sec, higher than any previous source. Dissociation at this intensity was 55%, and larger atomic oxygen percentage can be obtained at lower oxygen partial pressures. Author

N77-23908# Wayne State Univ., Detroit, Mich.
ELECTRONIC RELAXATION PROCESSES IN POLYATOMIC MOLECULES Progress Report, 1 Oct. 1975 - 30 Sep. 1976
E. C. Lim Sep. 1976 10 p
(Contract E(11-1)-2192)
(COO-2192-22) Avail: NTIS HC A02/MF A01

Excitation energy dependence of radiationless decay rate under collision-free conditions was utilized as a probe of intramolecular vibrational relaxation in tetracene and pentacene. The results give evidence of vibrational relaxation which competes with electronic relaxation. The substitution dependence of T sub 1(npion*) yields S0 radiationless transition in monocyclic diazines and the temperature dependence of S1 nonradiative decay rate in alcoholic solutions of polycyclic monoazines indicate that the vibronic interaction between the lowest energy npion* and pionpion* states leads to a rapid radiationless deactivation of the lower of the two electronic states. Finally, a photon counting spectrofluorometer of very high sensitivity was constructed, and it was used to record T2 yields T1 fluorescence in bromoanthracenes and S2 yields S1 fluorescence in azulene. ERA

N77-23909# Armed Forces Radiobiology Research Inst., Bethesda, Md.
ORGANOMETALLIC LIQUIDS AS POTENTIAL DOSIMETRIC MATERIALS: A PULSE RADIOLYSIS STUDY OF THE TETRA-ALKYL COMPOUNDS OF Si, Sn AND Pb
J. L. Hosszu Jun. 1976 12 p refs
(AD-A033409; AFRRI-TN76-3) Avail: NTIS HC A02/MF A01 CSCL 07/5

The methods of kinetic optical spectroscopy have been employed to observe the very short-lived transients produced by pulse radiolysis of some of the tetra-alkyl compounds of Si, Sn, and Pb doped with naphthalene and toluene. The feasibility of utilizing such bimolecular compounds for time resolved dosimeters in the low-energy x-ray region has been demonstrated. This represents an additional method for refinement of the pulsed radiation profiles such as might be encountered in nuclear weapons uses. Author (GRA)

N77-23910# New York Univ., N. Y. Dept. of Physics.
MULTIPLE PHOTO IONIZATION PROCESSES IN ATOMS Final Report
Edward J. Robinson Jun. 1976 24 p refs
(Contract N00014-67-A-0467-0002)
(AD-A032819) Avail: NTIS HC A02/MF A01 CSCL 20/6

The advent of the laser has brought about a revolution in the kinds of experimental phenomena that can be investigated. In particular, ultra-high power monochromatic, collimated sources have intensities of sufficient magnitude to enable studies to be carried out in the regime where 'non-linear' effects are important, even dominant. Important among these are processes which are characterised by the simultaneous absorption of two or more optical photons. While multiple photon processes are not completely new, those in the optical part of the spectrum, like Raman scattering, have, until the advent of the laser, been thought of as linear in the incident intensity, or, like the two-quantum decay of the metastable 2s states of hydrogen-like atoms and ions, been confined to theory. Of the multiple photon, non-linear optical processes, multiquantum ionization is one of the more fruitful for detailed, quantitative measurements, and for comparison with theory, since (1) one does not require precise coincidence between the laser light and an absorption line (2) the ionizations can be detected unambiguously with 100% efficiency (3) atomic wave functions are simple, and sufficiently accurate to enable one to make reasonable precise calculations. GRA

N77-23911# Pennsylvania State Univ., University Park. Applied Research Lab.
HELIUM ATOMIC BEAM SCATTERING FROM CLEAN (001) SURFACES OF NaF M.S. Thesis
Michael P. Liva 5 Oct. 1976 79 p refs
(Contract N00017-73-C-1418)
(AD-A033487; TM-76-250) Avail: NTIS HC A05/MF A01 CSCL 20/2

Several improvements were developed for the atomic beam apparatus, including stabilization of the inlet temperature, cooling of the sample and the titanium sublimator, methods of precise alignment, and more accurate measurement of the beam angles. Measurements were made on the selective adsorption energy levels of He on NaF. Three levels were determined with good accuracy, and a fourth one was also roughly determined. From these, a well depth of 7.5 m and a Van der Waals constant, C(3) = 140 meV-A squared, can be estimated. Measurements of intensities of diffracted beams were also carried out, and the two new phenomena recently predicted on theoretical grounds were found. These are the occurrence of intensity maxima due to multiple transitions (incident to adsorbed to diffracted states), and the splitting of degeneracies in the energy levels due to perturbations by the periodic potential. Both of these effects provide new approaches to the determination of the potential parameters. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N77-23912 Michigan State Univ., East Lansing.
EMPIRICAL RENORMALIZATION OF SHELL-MODEL HAMILTONIANS AND MAGNETIC DIPOLE MOMENTS OF sd-SHELL NUCLEI Ph.D. Thesis
Wilton Chung 1976 144 p
Avail: Univ. Microfilms Order No. 77-5780

A refined technique for using energy level data to renormalize shell model Hamiltonians is described. The one and two body matrix elements of the Hamiltonian are treated as parameters and determined by an iterative least squares fit to experimental energy level data. To overcome the problems associated with the large number of correlated parameters involved, the least squares fit is reformulated in terms of orthogonal linear combinations of the one and two body matrix elements. Empirical Hamiltonians for full 0d 5/2-1s 1/2-0d 3/2 space shell model calculations are determined by the described technique using energy level data at either the lower or upper end of the sd shell. In addition wave functions generated from renormalized Hamiltonians are used to calculate magnetic dipole moments of some ground and excited states of sd shell nuclei.Dissert. Abstr.

N77-23913 California Univ., Davis.
COMPARISON OF THE INTERACTING BOSON APPROXIMATION WITH AN EXACT SHELL MODEL CALCULATION ON THE 16O NUCLEUS Ph.D. Thesis
Frederica Dᴂrema-Rogers 1976 207 p
Avail: Univ. Microfilms Order No. 77-6329

The validity of the interacting Boson approximation (IBA) was examined, and the degree of success that this approximation has in explaining the structure of the O-16 nucleus was investigated. An extension of the IBA, the hybrid Boson approximation (HBA), is proposed which corrects some of the deficiencies of the IBA. The results of the two approximate methods are compared with an exact shell model calculation in the case of the (0+,0) and 2+,0) two hole-two particle states. These calculations were done for a Gaussian and a zero-range two-body interaction, and within the configuration space chosen, the holes were restricted in the p shell and the particles in the s-d shell. The relevant matrix elements of the Hamiltonian are given in detail, and the spuriocity of the center of mass motion is almost completely removed in the exact calculation.
Dissert. Abstr.

N77-23914*# California Univ., Berkeley. Inst. of Governmental Studies.
SPACE DISPOSAL OF NUCLEAR WASTES: SOCIO-POLITICAL ASPECTS, VOLUME 2
T. LaPorte, D. Metlay, and P. Windham Dec. 1976 187 p refs 2 Vol.
(Grants NsG-2160; NCA-2-OR-050-603)
(NASA-CR-153054) Avail: NTIS HC A09/MF A01 CSCL 18G

The character and scope of the secondary impacts of a space disposal program on the daily lives of people are estimated. These include public health and safety, environmental concerns, socioeconomic benefits and costs, civil liberties, and psychological effects. The types of accidents that might occur during space disposal operations and their indirect as well as direct consequences are discussed as well as the difficulties involved in constructing a management and operational organization that maintains the required high level of vigilance and performance over many years of routine operation. Author

N77-23915# Naval Research Lab., Washington, D. C.
TOKAMAK PLASMA HEATING WITH INTENSE PULSED ION BEAMS
Wallace M. Manheimer, Edward Ott, and Irving Haber 1976 10 p refs Presented at the 3d Intern. Meeting on Theoretical and Experimental Aspects of Heating of Toroidal Plasmas, Grenoble, France, 28 Jun. - 2 Jul. 1976
(Contract E(49-20)-1006)
(CONF-760637-2) Avail: NTIS HC A02/MF A01

The temporal evolution of the temperature profile of an RF heated plasma torus is calculated. The model includes the following effects: (1) inward energy transport by externally launched lower hybrid waves which Landau damp and heat the plasma as they propagate from the plasma edge to the vicinity of the lower hydrid resonance where the remainder of their energy is deposited; (2) quasilinear plateau formation and the competing effect of Fokker-Planck collisions; (3) electron and ion thermal conductivity; and (4) temperature equilibration. The implications of various models of the thermal conductivity (neoclassical, pseudoclassical, and anomalous) and of the heat deposition near the resonance (mode conversion, parametric instabilities, etc.) are investigated. It is found that quasilinear flattening is effective in reducing the Landau damping of the lower hybrid waves and thereby prevents large amounts of energy from being deposited in the outer regions of the plasma. ERA

N77-23916# Army Scientific Advisory Panel, Washington, D. C.
ARMY SCIENTIFIC ADVISORY PANEL AD HOC GROUP ON PULSED REACTORS Final Report
Richard L. Wagner, Jr., Donald M. Kerr, Jr., and John Meehan, Jr. Nov. 1976 11 p
(AD-A032157) Avail: NTIS HC A02/MF A01 CSCL 18/13

The Ad Hoc Group was asked to review the technical capabilities of the Army's two pulsed reactor facilities at White Sands Missile Range (the fast burst reactor (FBR)) and at Aberdeen Proving Ground (the Aberdeen Pulsed Reactor Facility)), and to review the technical considerations for a decision to close one, should that become necessary. We conclude that both facilities are operated safely, efficiently, and in a manner responsive to user needs; that the national workload is likely to be such that both should be retained for the foreseeable future; but that if only one can be retained, it should be the one most capable of supporting a high technology program, and that the APRF reactor is that one. GRA

N77-23917# Naval Research Lab., Washington, D. C.
GENERATION OF FRACTION OF A TERAWATT PROTON PULSES WITH COAXIAL REFLEX TRIODES Interim Report
J. Golden, C. A. Kapetanakos, S. J. Marsh, and S. J. Stephanakis Dec. 1976 21 p refs
(NRL Proj. H02-28A)
(AD-A033873; NRL-MR-3422) Avail: NTIS HC A02/MF A01 CSCL 20/7

Results are reported on the generation of MeV, pulsed ion beams at a peak power level in excess of 2 X 10 to the 11th power watts that have an angular divergence of about 3 deg - 4 deg. Such beams can be used in the formation of field reversing proton rings. GRA

N77-23918# Austin Research Associates, Inc., Tex.
CONCEPTUAL DESIGN OF AN AUTO-RESONANT ACCELERATOR EXPERIMENT Final Report
William E. Drummond, George I. Bourianoff, Edward P. Cornet, David E. Hasti, and William W. Rienstra Nov. 1976 306 p refs
(Contract F29601-76-C-0046)
(AD-A033946; ARA-224; I-ARA-76-U-44; AFWL-TR-76-152) Avail: NTIS HC A14/MF A01 CSCL 20/7

Conceptual design and specifications for a proof-of-principal Auto-Resonant Accelerator have been undertaken. In particular, the pulse power source and diode configuration, the diode to waveguide transition and compression sections, magnetic field characteristics, phase locking and wavegrowth requirements, and the method of ion loading and acceleration have been examined. Specifications and conceptual designs for these five areas are presented along with several considerations of overall system requirements. Author (GRA)

74 OPTICS

Includes light phenomena.

N77-23919 Arizona Univ., Tucson.
ABERRATIONAL ANALYSIS OF OPTICAL SYSTEMS: A PROXIMATE RAY TRACE APPROACH Ph.D. Thesis
George William Hopkins, II 1976 133 p
Avail: Univ. Microfilms Order No. 77-6053

Algebraic ray trace equations for axially symmetric optical systems are expanded in terms of system parameters and paraxial variables. The transfer parameter used is optical path length, and equations are given for second, fourth, sixth, and eighth order differences in optical path length from the axial value. Transverse and angular errors to third, fifth, and seventh order are also given by these proximate ray trace equations. The geometrical imagery implied by the first order proximate ray trace equations is described and related to actual optical systems. Selected rays are then traced to a tilted reference sphere in the exit pupil, image errors of given order are equated to the corresponding aberration polynomial (either wave or transverse), and the resulting linear equations are solved for aberration coefficients. Finally, a FORTRAN computer program based on proximate ray tracing, is described. Dissert. Abstr.

N77-23920 Cornell Univ., Ithaca, N.Y.
THIN-FILM OPTICS Ph.D. Thesis
Bor-Uei Chen 1976 120 p
Avail: Univ. Microfilms Order No. 77-5733

The propagation and generation of optical waves in thin-film waveguides and the techniques for fabricating and evaluating miniaturized optical components in thin film form were investigated. Passive optical elements such as grating couplers and waveguides and active thin film optical devices such as harmonic generators and Nd-glass waveguide amplifiers were fabricated and studied. Three experiments concerning phase matched or nonphase matched second harmonic generation in the ultraviolet region using thin film waveguide structures were performed. Phase matching of the second harmonic wave was achieved either by controlling the thin film thickness or by incorporating a periodic structure in the waveguide. Nonphase matched second harmonic wave in the form of Cerenkov radiation was also generated. In addition the feasibility of fabricating a Nd-glass thin film waveguide laser was studied. Dissert. Abstr.

N77-23921 Cornell Univ., Ithaca, N.Y.
WAVE-COUPLING IN PERIODIC OPTICAL WAVEGUIDES Ph.D. Thesis
Cesar Celeste Ghizoni 1976 144 p
Avail: Univ. Microfilms Order No. 77-5743

A theory of periodic waveguides was developed using Green's functions of the unperturbed slab waveguide as a basis for a set of coupled integral equations. Problems considered are: (1) diffraction of an incident plane wave upon the surface; (2) attenuation of a guided wave as it propagates in the periodic waveguide; (3) excitation of a guided surface wave by an incident plane wave on the structure; (4) self-excitation of the structure by means of a distributed feedback mechanism provided by the periodic structure; and (5) generation of second harmonic from a fundamental guided wave where the periodic structure is used to obtain phase-matching. Dissert. Abstr.

N77-23922 Arizona Univ., Tucson.
IMAGE QUALITY CRITERIA FOR ABERRATED SYSTEMS Ph.D. Thesis
Melvyn Howard Kreitzer 1976 107 p
Avail: Univ. Microfilms Order No. 77-6063

A continuum is established between the physically significant extremes of the mean squared spot size and the variance of the wavefront aberration. This is achieved by obtaining an analytical second order expansion of the optical transfer function (OTF), including most of the wave aberrations through eighth order. This expression is then multiplied by a weighting function that approximates the transfer function of a typical detector, and the product is integrated over spatial frequency and azimuthal angle. The continuum is a smooth function of a single parameter characterizing the width of the weighting function. The second-order OTF expansion and the continuum obtained from it are both expressed in orthonormalized form so that a detailed study can be made of the behavior of the separable balancing and weighting coefficients. Dissert. Abstr.

N77-23923# Construction Engineering Research Lab. (Army), Champaign, Ill.
FIBER OPTIC COMMUNICATIONS LINK PERFORMANCE IN EMP AND INTENSE LIGHT TRANSIENT ENVIRONMENTS Interim Report
Ray G. McCormack and David C. Sieber Oct. 1976 24 p refs
(AD-A032126; CERL-IR-E-94) Avail: NTIS HC A02/MF A01 CSCL 18/6

Optical fiber communications links are a possible means for providing voice and data transmission electromagnetic pulse (EMP) hardened facilities. This report describes evaluations of the effects of high-level EMP fields and intense light flashes on fiber links. The results show that neither EMP fields nor light transients have any appreciable effect on the fiber links. Further evaluations, which were performed in EMP fields to compare the data transmission system using an optical fiber with an equivalent system using conventional cabling, showed the conventional system is susceptible to EMP. The optical link is thus superior in the EMP environment. Author (GRA)

N77-23924# Avco Systems Div., Wilmington, Mass.
SWITCH DRIVER CONCEPT DEVELOPMENT Final Report
Murray E. Wolf Nov. 1976 99 p
(Contract DAAA21-76-C-0203)
(AD-A032575; AVSD-0318-76-RR) Avail: NTIS HC A05/MF A01 CSCL 20/6

The report describes the design concept of a unique signal switch driver along with program objectives, design requirements, supporting analyses and functional test results. The report concludes that the design concept is sound and will meet all the design requirements with a 60 Hz response capability. Follow-on development is recommended. Author (GRA)

N77-23925# Illinois Univ., Chicago. Communications Lab.
COUPLING BETWEEN RECTANGULAR OPTICAL WAVEGUIDES M.S. Thesis
Abdul-Ghaffar Kazkaz and Piergiorgio L. E. Uslenghi Dec. 1976 67 p refs
(Grant AF-AFOSR-2263-72)
(AD-A034910; AFOSR-77-0007TR) Avail: NTIS HC A04/MF A01 CSCL 20/6

A theory is developed for strong coupling between two rectangular optical waveguides, that contains the Miller-Marcatili result as a limiting case. The theory allows for a more accurate design of a directional coupler than was previously possible. GRA

N77-23926# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTICAL EFFICIENCY MEASUREMENTS OF GEODSS TELESCOPES
Eugene W. Rork 8 Oct. 1976 11 p refs
(Contract F19628-76-C-0002)
(AD-A033945; ETS-5; ESD-TR-76-306) Avail: NTIS HC A02/MF A01 CSCL 20/6

Optical Efficiency Measurements are reported for three telescopes used at the GEODSS Experimental Test System. The results of the measurements are needed to evaluate electro-optical sensor performance. The optical efficiency is not a reflection on the manufacturer's skills but rather the number of optical pieces and coatings we have specified, and the dust collected during the operating period. Author (GRA)

N77-23927# Metavac, Inc., Flushing, N. Y.
PRODUCTION ENGINEERING MEASURES FOR FILTER, INFRARED, INTERFERENCE-ABSORPTION TYPE Quarterly Report, 1 Jun. - 31 Aug. 1976
John Monte 8 Oct. 1976 18 p
(Contract DAAB07-74-C-0379)
(AD-A033788; QR-9) Avail: NTIS HC A02/MF A01 CSCL 20/6

Acceptance tests are being conducted for several types of infrared filters for the AN/VSS-3A, a 1kw searchlight. Several spectral transmission curves are presented. GRA

N77-23928# Hughes Research Labs., Malibu, Calif.
THIN FILM OPTICAL SWITCH Quarterly Report, 22 Jul. - 21 Oct. 1976

Bor-Uei Chen and Gregory Tangonan Nov. 1976 19 p refs (Contract N00173-76-C-0113)
(AD-A034677; QR-3) Avail: NTIS HC A02/MF A01

During the third quarter of this program, the measurement of single mode coupling efficiency for linear tapers of four different taper lengths was continued. For TM wave propagation, the coupling efficiency was much lower than for TE wave propagation. The difference in coupling efficiency was due to the presence of Li2O out-diffusion waveguide modes, which occurred only when the TE mode was excited in Ti-diffused channel guide. The coupling efficiency of a given taper structure depends strongly on the expansion ratio of the channel width (final width to initial channel width). So it is important to know the amount of lateral diffusion which proceeds simultaneously with the downward diffusion. We have studied the Ti concentration profile near the edge of a stripe of 70 microns initial width using electron microprobe technique. The lateral spread of this 70 microns wide channel guide was about 6 micrometers on each side. We concluded that enhanced lateral diffusion was not observed in this study. GRA

N77-23929# Texas Instruments, Inc., Dallas. Equipment Group.
VIDEO CONTROLLED FLIR FOCUS Final Technical Report, 5 Jun. 1975 - 31 May 1976
E. Elwell, Joseph Lewis, and K. Stelzenmuller Wright-Patterson AFB, Ohio AFAL Nov. 1976 30 p refs
(Contract F33615-75-C-1197; AF Proj. 2004)
(AD-A034116; AFAL-TR-76-161) Avail: NTIS HC A03/MF A01 CSCL 17/5

The objective of the program was to invent, design, breadboard and demonstrate an automatic focusing device and a dynamic range expansion system to be used with FLIR sensors. The scene analysis, breadboard implementation and test results of both tasks are covered. GRA

N77-23930# RCA Labs., Princeton, N. J.
CHARGE-COUPLED SCANNED IR IMAGING SENSORS Semiannual Report, 1 Nov. 1975 - 30 Apr. 1976
Elliott S. Kohn Griffiss AFB, N. Y. RADC Sep. 1976 31 p refs
(Contract F19628-73-C-0282; ARPA Order 2444)
(AD-A034107; PRRL-76-CR-29; RADC-TR-76-277; SAR-5)
Avail: NTIS HC A03/MF A01 CSCL 17/5

A program is under way to fabricate infrared-sensitive, charge-coupled imagers with Schottky-Barrier detectors. The previous work has been with three-phase, single metallization line arrays using palladium-silicide, Schottky-Barrier detectors. The present effort is directed at fabrication of a 25 x 50 area array. The design of the 25 x 50 area array is nearly complete, and masks will soon be ordered. Arrays of this design will be made with both Pd2 Si and Pt Si Schottky Barriers. There will be optional masks for guard rings and for buried-channel operation. Processing has begun on a batch of wafers with Pt. Optical absorption measurements revealed a possible problem in the processing procedure, and an appropriate change was made. Infrared calculations were made demonstrating that thermal imaging with Pt Si is possible, but that excess dark current at the detectors must be avoided. GRA

N77-23931# Dumont Electron Tubes, Clifton, N.J.
STUDY AND IMPROVEMENT OF THE S-1 PHOTOEMISSIVE SURFACE Final Report, Jul. 1966 - Jun. 1969
Hans Timan 18 Jul. 1969 130 p
(Contracts DA-44-009-AMC-1811(E); DA-44-009-AMC-136(T))
(AD-A034076; ETC-116-69-A) Avail: NTIS HC A07/MF A01 CSCL 17/5

The primary interest in this investigation was directed toward practical goals. In the first two-thirds of the effort, this meant improvement of the luminous and infrared sensitivity of the semitransparent S-1 and suppression of its thermionic emission. GRA

N77-23932# Edgewood Arsenal, Aberdeen Proving Ground, Md.
A CATALOG OF OPTICAL EXTINCTION DATA FOR VARIOUS AEROSOLS/SMOKES Special Publication, 22 Aug. - 5 Dec. 1975
Merrill Milham Jun. 1976 83 p
(DA Proj. 1L6-62619-AO-65)
(AD-A034500; ED-SP-77002) Avail: NTIS HC A05/MF A01 CSCL 07/4

Extinction spectra in the 3- to 5-, 8- to 13-, and 0.4 to 2.4-micrometer spectral region have been obtained for FS (Chlorosulfonic acid - Free SO3), red phosphorus HC (Zinc oxide, Aluminum, Hexachloroethane), and fog oil smokes. A limited number of theoretical predictions based on Mie theory are also presented and compared with the experimental results. The experimental and computational procedures are described in some detail. These findings are subject to revision; the final report will be published later. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N77-23933 Princeton Univ., N. J.
PHYSICAL PROCESSES IN HOLLOW CATHODES IN HIGH CURRENT DISCHARGES Ph.D. Thesis
Mahadevan Krishnan 1976 222 p
Avail: Univ. Microfilms Order No. 77-6031

Large (2 cm diameter) hollow cathodes were operated in a magnetoplasmadynamic arc over wide ranges of current (0.25 to 17 kA) and mass flow (0.001 to 8 g/sec), with orifice current densities and mass fluxes encompassing those encountered in low current steady state hollow cathode arcs. Detailed cathode interior measurements of current and potential distributions show that maximum current penetration into the cathode is about one diameter axially upstream from the tip, with peak inner surface current attachment up to one cathode diameter upstream of the tip. Emission and conduction processes at the cathode surface were investigated. From several candidate emission models, it was speculated that a form of field enhanced photoelectric emission is a possible primary emission mechanism in such cathodes. Dissert. Abstr.

N77-23934 Michigan State Univ., East Lansing.
AN INVESTIGATION OF THE ELECTROMAGNETIC BEHAVIOR OF A MICROWAVE PLASMA SOURCE OVER A WIDE RANGE OF PRESSURES AND FLOW RATES Ph.D. Thesis
Raghuveer Mallavarpu 1976 210 p
Avail: Univ. Microfilms Order No. 77-5851

The plasma source under study is a variable length microwave cavity partially filled with a cold, lossy, isotropic, homogeneous plasma column enclosed in a quartz tube. A small signal linear theory which neglects the flow rate of the gases, but takes into account the pressure dependence of the discharge, is used to qualitatively explain some of the observed experimental results. Dissert. Abstr.

N77-23935 California Univ., Berkeley.
PROPAGATION OF AN INTENSE ELECTRON BEAM IN NEUTRAL GAS ALONG A STRONG MAGNETIC FIELD Ph.D. Thesis
Booth Richard Myers 1976 192 p
Avail: Univ. Microfilms Order No. 77-4551

Two propagation chambers were used, one with a length comparable to the beam diameter, and a second long chamber with a length much greater than the beam diameter. It is concluded that the application of a magnetic guide field has three principal effects on beam propagation: (1) the Alfven current limit is relaxed when the guide field is much stronger than the beam self magnetic field, (2) the magnetic guide field constrains secondary electron motion, and (3) filamentation of the beam in the diode is seen at high magnetic fields. It is concluded that this has little effect on the space charge neutralization process, but strongly affects the current neutralization of the beam. A one dimensional model of the virtual cathode, generated when the beam is first turned on, is developed. This model includes both beam velocity spread and effects of the ionization of a background gas. The results of this model are compared with experimental results. Dissert. Abstr.

N77-23936*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RESULTS OF CLOSED CYCLE MHD POWER GENERATION TEST WITH A HELIUM-CESIUM WORKING FLUID
Ronald J. Sovie 1977 10 p refs Presented at the 16th Symp. on the Engr. Aspects of Magnetohydrodynamics, Pittsburgh, Pa., 16-18 May 1977
(NASA-TM-X-73621; E-9112) Avail: NTIS HC A02/MF A01 CSCL 20I

The cross sectional dimensions of the MHD channel in the NASA Lewis closed loop facility were reduced to 3.8 x 11.4 cm. Tests were run in this channel using a helium-cesium working fluid at stagnation pressures of 160,000 n/M2, stagnation temperatures of 2000-2060 K and an entrance Mach number of 0.36. In these tests Faraday open circuit voltages of 200 V were measured which correspond to a Faraday field of 1750 V/M. Power generation tests were run for different groups of electrode configurations and channel lengths. Hall fields up to 1450 V/M were generated. Power extraction per electrode of 183 W and power densities of 1.7 MW/M3 were obtained. A total power output of 2 kW was generated for tests with 14 electrodes. The power densities obtained in this channel represent a factor of 3 improvement over those previously reported for the M = 0.2 channel. Author

N77-23937*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPECTROSCOPIC DETERMINATION OF ELECTRICAL CONDUCTIVITY IN AN MHD DUCT FROM ABSOLUTE INTENSITY MEASUREMENTS
S. Y. Wang and Marlin Smith 1977 8 p refs Presented at 16th Symp. on Engr. Aspects of Magnetohydrodynamics, Pittsburgh, 16-18 May 1977
(NASA-TM-X-73626; E-9118) Avail: NTIS HC A02/MF A01 CSCL 20I

Measurements of the electrical conductivity in the NASA Lewis cesium seeded, H2-O2 MHD duct have been previously reported. In order to corroborate the above measurements and to analyze the possibility of nonuniform seed injection as a cause of the deviations, a spectroscopic investigation of the plasma conductivity has been undertaken. Transverse profiles of the absolute integrated intensity were measured from the optically thin lines of CSI-.5664 microns and .5636 microns. Radial profiles of emission coefficient were obtained from the measured transverse profiles of intensity by Abel inversion. Radial profiles of electrical conductivity were then obtained under two different assumptions. In the first, the Cs seed fraction is assumed uniform and equal to the measured flow rate at the time when the temperature and conductivity were obtained. In the second method, the local temperature and pressure are taken to be those given by a one-dimensional channel calculation including heat transfer and friction. In this case profiles of conductivity and seed fractions are obtained. The results of the two methods are compared to the previously measured conductivity. Author

N77-23938# Princeton Univ., N. J. Plasma Physics Lab.
RECENT DEVELOPMENTS IN THE COMPUTATIONAL ASPECTS OF MHD STABILITY
R. C Grimm and J. L. Johnson Aug. 1976 27 p refs
(Contract E(11-1)-3073)
(MATT-1269) Avail: NTIS HC A03/MF A01

Variational methods have been successfully applied in the numerical determination of the spectra for simple linearized ideal magnetohydrodynamic models. Several extensive efforts have been undertaken to implement these approaches to determine the normal modes for general axisymmetric toroidal equilibria, especially those applicable to the Tokamak experimental program. The motivation, the difficulties, and the various numerical approaches are reviewed. ERA

N77-23939# California Univ., Livermore. Lawrence Livermore Lab.
MIRROR FUSION-FISSION REACTOR DESIGNS
R. W. Moir 1 Aug. 1976 14 p refs Presented at US-USSR Symp. on Fusion-Fission Reactors, Livermore, Calif., 13-16 Jul. 1976
(Contract W-7405-eng-48)
(UCRL-78629; Conf-760733-7) Avail: NTIS HC A02/MF A01

The role of hybrid reactors is discussed, and the mirror approach and other approaches are compared. Past and present mirror hybrid studies are reviewed. A comparison between the hybrid and fusion reactors is made; the conclusion is that hybrids are technologically less demanding in many ways except in dealing with fission wastes. Finally, the development steps that might lead to a commercial hybrid are discussed. ERA

N77-23940# Argonne National Lab., Ill.
TOKAMAK EXPERIMENTAL POWER REACTOR CONCEPTUAL DESIGN, VOLUME 1
Aug. 1976 674 p refs
(Contract W-31-109-eng-38)
(ANL/CTR-76-3-Vol-1) Avail: NTIS HC A99/MF A01

A conceptual design has been developed for a Tokamak experimental power reactor to operate at net electrical power conditions with a plant capacity factor of 50 percent for 10 years. The EPR operates in a pulsed mode at a frequency of approximately 1/min., with an approximate 75 percent duty cycle, is capable of producing approximately 72 MWe and requires 42 MWe. The annual tritium consumption is 16 kg. The EPR vacuum chamber is 6.25 m in major radius and 2.4 m in minor radius, is constructed of 2-cm thick stainless steel, and has 2-cm thick detachable, berylium-coated coolant panels mounted on the interior. An 0.28 m, stainless steel blanket and a shield ranging from 0.6 to 1.0 m surround the vacuum vessel. The coolant is H2O. Sixteen niobium-titanium superconducting toroidal-field coils provide a field of 10 T at the coil and 4.47 T at the plasma. Superconducting ohmic-heating and equilibrium-field coils provide 135 V-s to drive the plasma current. Plasma heating is accomplished by 12 neutral beam-injectors, which provide 60 MW. ERA

N77-23941# Argonne National Lab., Ill.
TOKAMAK EXPERIMENTAL POWER REACTOR CONCEPTUAL DESIGN, VOLUME 2
Aug. 1976 304 p refs
(Contract W-31-109-eng-38)
(ANL/CTR-76-3-Vol-2) Avail: NTIS HC A14/MF A01

Volume II contains the following appendices: (1) summary EPR design parameters, (2) impurity control, (3) plasma computational models, (4) structural support system, (5) materials considerations for the primary energy conversion system, (6) magnetics, (7) neutronics penetration analysis, (8) first wall stress analysis, (9) enrichment of isotopes of hydrogen by cryogenic distillation, and (10) noncircular plasma considerations. ERA

N77-23942# Princeton Univ., N. J. Plasma Physics Lab.
TOKAMAK HYBRID STUDY
F. H. Tenney Sep. 1976 12 p Presented at the Joint US-USSR Symp. on Fusion-Fission Reactors, Livermore, Calif., 13-16 Jul. 1976
(Contract E(11-1)-3073)
(PPPL-1284; Conf-760733-6) Avail: NTIS HC A02/MF A01

A Tokamak hybrid reactor is studied. The plasma is maintained by both D and T beams. To obtain long burn times a poloidal field divertor is required. Both the single null and the double null style of divertor are considered. The blanket consists of a neutron multiplier region containing natural uranium followed by burner regions of molten salt (flibe) loaded with PuF3 to enhance the energy multiplication. Economic analysis has been applied only recently to a variety of reactor sizes and plasma conditions. Early indications suggest that the most attractive hybrids will have large plasmas of major radius in excess of 8 meters. ERA

N77-23943# Princeton Univ., N. J. Plasma Physics Lab.
COMPUTATIONAL STUDY OF AXISYMMETRIC MODES IN NONCIRCULAR CROSS SECTION TOKAMAKS
J. L. Johnson, M. S. Chance, J. M. Green, R. C. Grimm, S. C. Jardin, W. Kerner, J. Manickam, and K. E. Weimer Sep. 1976 6 p refs Presented at the 6th Intern. Conf. on Plasma Physics and Controlled Nuclear Fusion Research, Berchtesgaden, West Germany, 6-13 Oct. 1976
(Contract E(11-1)-3073)
(PPPL-1283; Conf-761012-21; IAEA-CN-35/B11-2) Avail: NTIS HC A02/MF A01

A major computational program to investigate the equilibrium, stability, and nonlinear evolution properties of realistic Tokamak

configurations is proceeding. Both axisymmetric (n = 0) modes and kink (n = 1) modes are found; the growth rates depend sensitively on the configuration. A study of the nonlinear evolution of axisymmetric modes in such a device shows that flux conservation in the vacuum region can limit their growth. ERA

N77-23944# Princeton Univ., N. J. Plasma Physics Lab.
LINEAR AND NONLINEAR THEORY OF TRAPPED-PARTICLE INSTABILITIES
W. M. Tang, J. C. Adam, B. I. Cohen, E. A. Frieman, J. A. Krommes, G. Rewoldt, D. W. Ross (Texas Univ., Austin), M. N. Rosenbluth, P. H. Rutherford, P. J. Catto (Rochester Univ., N. Y. et al Sep. 1976 12 p refs Presented at the 6th Intern Conf. on Plasma Physics and Controlled Nuclear Fusion Research, Berchtesgaden, W. Germany, 6-13 Oct. 1976
(Contracts E(11-1)-3073; E(11-1)-3237; E(40-1)-4478)
(PPPL-1279; Conf-761012-19) Avail: NTIS HC A02/MF A01

For trapped electron modes, the complete two dimensional (2D) spatial structure, including the effects of magnetic shear, is numerically calculated within the framework of a differential formulation for long radial wavelength modes. Growth rates obtained for representative cases correlate reasonably well with the usual one dimensional (1D) estimates of shear stabilization. However, the spatial structure of the mode differs markedly; e.g., it typically extends over several mode rational surfaces. At the shorter wavelengths, where the maximum growth rates of the modes typically occur, it is necessary to introduce an integral equation formulation for calculating the radial dependence. Growth rates from this 2D analysis are significantly smaller than 1D estimates, and the poloidal model structure exhibits a pronounced localization at the magnetic field minimum. Specific collisional mechanisms affecting the linear stability of these modes are also studied. ERA

N77-23945# Columbia Univ., New York.
EXPERIMENTAL AND THEORETICAL STUDIES OF BELT PINCHES AND HIGH-BETA TOKAMAKS
C. K. Chu, R. A. Gross, H. C. Lui, M. Reusch, F. Sandel, K. L. Wong, A. W. Allen (Md. Univ., College Park), G. C. Goldenbaum (Md. Univ., College Park), J. A. Tataronis (New York Univ., N. Y.), and W. Grossmann (New York Univ., N. Y.) 1976 15 p refs Presented at 6th Intern. Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Berchtesgarden, West Ger., 6 Oct. 1976
(Contract E(11-1)-2456)
(COO-2456-38; Conf-761012-16; IAEA-CN-35/E8) Avail: NTIS HC A02/MF A01

Several experimental and theoretical studies of belt pinches and high-beta Tokamaks are summarized. Numerical calculations supporting these experiments include equilibrium, stability, heating, and initial implosion dynamics. A general stability analysis of diffuse belt pinch configurations is reported. Results indicate that favorable stability properties can be obtained by shaping the current density profile and plasma geometry. ERA

N77-23946# Los Alamos Scientific Lab., N. Mex.
INERTIAL AND INDUCTIVE ENERGY STORAGE FOR FUSION SYSTEMS
J. D. Rogers 1976 12 p refs Presented at 2nd Topical Meeting on the Technol. of Controlled Nucl. Fusion, Richland, Wash., 21 Sep. 1976
(Contract W-7405-eng-36)
(LA-UR-76-1925; Conf-760935-18) Avail: NTIS HC A02/MF A01

The plasma physics for confinement and primarily the energy transfer time determine the nature of the storage system. Discharge times vary from 0.7 ms for theta-pinch reactors to one to two seconds for tokamak reactors. Three classes of devices are available for energy storage-inductors, capacitors, and rotating machines. The transfer of the energy from the store imposes unusual switching requirements. The broad requirements for reactor energy stores and more specifically those for tokamak experimental power reactors (EPR) and for the Scyllac fusion test reactor (SFTR) are presented. Assessments and comparisons of alternative energy storage and transfer systems for these devices are to be discussed. The state of the pulsed superconducting inductive energy storage coils and homopolar development programs was emphasized. ERA

N77-23947# Oak Ridge National Lab., Tenn. Thermonuclear Div.
HIGH-PRESSURE, FLUX-CONSERVING TOKAMAK EQUILIBRIA
R. A. Dory and Y-K. M. Peng Aug. 1976 39 p refs Submitted for publication
(Contract W-7405-eng-26)
(ORNL/TM-555) Avail: NTIS HC A03/MF A01

The quasi-static evolution of FCI flux-conserving tokamak equilibria is studied as beta increases. An operating window is found in the pressure profile width w/sub p/: for high beta the values of w/sub p/ must lie between 0.40 and 0.55 of the plasma minor width. Within this window plasma current and poloidal beta increase monotonically with beta. For fixed plasma boundary, significant poloidal surface currents are induced, but these can be eliminated by small increases in the plasma minor radius, the pressure profile width, and the vacuum toroidal field. ERA

N77-23948# California Univ., Livermore. Lawrence Livermore Lab.
MODIFICATION OF THE ELECTROSTATIC SHEATH BY SECONDARY EMISSION OF ELECTRONS
L. S. Hall and I. Bernstein 14 Oct. 1976 16 p refs
(Contract W-7405-eng-48)
(UCID-17273) Avail: NTIS HC A02/MF A01

The potential distribution at the surface of a rectilinear one dimensional plasma in the presence of wall-emitting secondary electrons is computed as a function of the secondary emission coefficient under a variety of plasma conditions. ERA

N77-23949# Princeton Univ., N. J. Plasma Physics Lab.
POWER BALANCE IN ATC COMPRESSED PLASMA
C. C. Daughney and K. Bol Nov. 1976 17 p refs
(Contract E(11-1)-3073)
(PPPL-1301) Avail: NTIS HC A02/MF A01

The A.T.C. compressed plasma equilibrium was sustained for several electron energy confinement times. An analysis of the power balance for this plasma gives a 2.0 to 2.5 msec confinement time for the compressed plasma compared with a 3.0 msec confinement time for the uncompressed plasma. ERA

N77-23950# Princeton Univ., N. J. Plasma Physics Lab.
NONLINEAR PROPAGATION OF LOWER HYBRID WAVES IN A PLASMA
P. K. Kaw, C. Z. Cheng, and L. Chen Nov. 1976 15 p refs
(Contract E(11-1)-3073)
(PPPL-1305) Avail: NTIS HC A02/MF A01

A model equation was used to investigate the competition between the electron E x B/sub o/ nonlinearities (which lead to parametric instabilities and anomalous absorption) and the electron polarization drift and ion nonlinearities (which induce filamentation and self-focusing effects) in the propagation of a large amplitude lower hybrid wave in a plasma. ERA

N77-23951# Wisconsin Univ., Madison. Dept. of Nuclear Engineering.
WHAT IS PAST IS PROLOGUE: FUTURE DIRECTIONS IN TOKAMAK POWER REACTOR DESIGN RESEARCH
R. W. Conn 1976 17 p refs Presented at 2nd Topical Meeting on the Technol. of Controlled Nucl. Fusion, Richland, Wash., 21 Sep. 1976 Sponsored by ERDA, EPRI, and Wisconsin Electric Utilities Research Foundation
(UWFDM-175; Conf-760935-43) Avail: NTIS HC A02/MF A01

The trends towards reduced reactor size and higher neutron loadings are discussed. Moving in this direction requires new approaches to many subsystem designs. New approaches and future directions in first wall and blanket designs that can achieve reliable operation and reasonable lifetime, the use of cyrogenic but normal aluminum magnets for the pulsed coils in a tokamak, blanket designs that allow elimination of the intermediate loop, and low activity shields and toroidal field magnets are described. A discussion is given of the future role of conceptual reactor design research and the need for close interactions with ongoing experiments in fusion technology. ERA

N77-23952# General Electric Co., Philadelphia, Pa. Space Div.
MHD GENERATOR INVESTIGATIONS Annual Report, 1 Jan. - 30 Sep. 1976
C. H. Marston, E. Tate, and B. Zauderer Nov. 1976 85 p refs
(Contract N00014-73-C-0039)
(AD-A032790) Avail: NTIS HC A05/MF A01 CSCL 20/9

Feasibility of self-excited MHD operation has been shown. Eight percent magnetic field augmentation using an initial field of 0.5 Tesla was obtained. The NASA Ames EAST facility capabilities as a high temperature, high pressure plasma source have been mapped in detail. A channel (Ames I) has been used on the EAST facility to check test-time, aerodynamic performance and construction materials. Design and construction of a preliminary (Ames II) pulsed, self-excited, MHD generator concept was completed. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N77-23953 Vanderbilt Univ., Nashville, Tenn.
INFRARED REFLECTIVITY AND RAMAN SPECTRA APPLIED TO CRYSTAL STRUCTURE AND OPTICAL CONSTANT DETERMINATION Ph.D. Thesis
John Michael Stencel 1976 171 p
Avail: Univ. Microfilms Order No. 77-6118

Specular reflection techniques were employed to obtain the infrared spectral characteristics of NaNO3 and PbWO4 from 50 to 4000/cm. Classical harmonic oscillator theory was applied to obtain the index of refraction, absorption coefficients, and fundamental mode frequencies of these crystals. Reststrahlen band fine structure produced by 2-phonon modes and crystal surface imperfections was investigated. Kramers-Kronig dispersion theory was applied to the PbWO4 reflection spectra, and the results were analyzed for contributions from high frequency cut-off errors and systematic reflectivity errors. Raman spectra were also obtained and analyzed for PbWO4. The possibility of using only spectroscopic information with group theory to determine a unique crystal structure for PbWO4 was investigated.
Dissert. Abstr.

N77-23954 Arizona Univ., Tucson.
WAVELENGTH AND MEAN LIFE STUDIES OF THE BEAM-FOIL SPECTRA OF PHOSPHORUS Ph.D. Thesis
Armand David Maio 1976 103 p
Avail: Univ. Microfilms Order No. 77-6064

The beam-foil technique was used to study the spectra of the higher charge states of phosphorus in the wavelength region 300-5000A. Using PH3 as a source, P(+) ions were accelerated to energies of 1.75 MeV, 3.0 MeV and 5.0 MeV, and the spectra were observed downstream from a thin carbon foil. The technique produced excited states of PIV-PIX. Nearly 300 spectral lines were observed and are given in a complete line list which includes relative intensity information and a partial classification. Mean lives of upper levels decaying via 16 prominent lines were measured. A continuously moving foil technique was used in these measurements to average out foil aging effects and beam fluctuations. Decay curves were computer analyzed to provide a least square fit to a sum of exponential decays thus giving decay constants for cascade components. Dissert. Abstr.

N77-23955 New York Univ., N. Y.
STRUCTURAL AND SYMMETRY ASPECTS OF NONLINEAR OPTICS Ph.D. Thesis
Glen Robert Crane 1976 141 p
Avail: Univ. Microfilms Order No. 77-5376

A method of obtaining crystal structural information from relatively simple optical measurements is described. It is shown that through a bond polarizability model of crystal optical nonlinear polarizability, optical second harmonic generation may be used to augment conventional X-ray techniques to observe the mechanics of crystal phase transitions and, in proper circumstances, to determine atomic positional parameters. Through the geometrical factors relating the macroscopic nonlinear coefficient d sub 11 of alpha-quartz to the second order polarizability of the silicon to oxygen bond, the temperature dependence of this coefficient was used to observe the rotation of the SiO4 tetrahedron (about the crystal x axis) through the alpha, beta phase transition. Dissert. Abstr.

N77-23956 Virginia Univ., Charlottesville.
THERMODYNAMIC AND TRANSPORT PROPERTIES OF THE HUBBARD MODEL IN A SELF-CONSISTENT TREATMENT Ph.D. Thesis
Ralph Richard DeMarco, Jr. 1976 115 p
Avail: Univ. Microfilms Order No. 77-159

The Hubbard model is approximated by a static, random, self-consistent, one-particle Hamiltonian incorporating magnetic order. The random potential experienced by an electron at a given site in the system is taken to have a binary alloy distribution. A short range order parameter is introduced which makes the potentials at nearest neighbor sites statistically dependent. By doing so both the electrical and magnetic properties of the system are placed on an equal footing here. Using an extension of the coherent potential approximation, the density of states is calculated enabling calculation of the thermodynamic properties (e.g., the free energy, etc.) and a transport property (the conductivity) of the system. Dissert. Abstr.

N77-23957 California Univ., Berkeley.
THEORY OF THE UNBIASED JOSEPHSON JUNCTION PARAMETRIC AMPLIFIER Ph.D. Thesis
Marc Jere Feldman 1976 189 p
Avail: Univ. Microfilms Order No. 77-4451

Equations describing parametric amplification with an unbiased series array of Josephson junctions are presented. The noise temperature of this device, and compute its bandwidth and pump powerwidth are calculated. The equations describe saturation by thermal radiation. A detailed comparison of the theory is made with previous experiments using a series array of Josephson microbridges as the active element. In most instances the experiments are found to agree well with the theory. Throughout this work are extensive intuitive discussions of the meaning and relevance of the various parameters, equations, and concepts involved in the theory. Dissert. Abstr.

N77-23958 Yeshiva Univ., New York.
MANY-BODY THEORY OF A LOCALIZED PHONON IN AN ELECTRON GAS Ph.D. Thesis
Rafael Edgar Pena 1976 99 p
Avail: Univ. Microfilms Order No. 77-4997

The many body dynamic interaction of an elastic impurity with the electrons of a simple metal is considered. The three-dimensional problem is approximated by three independent one-dimensional problems each of which is then given an essentially exact solution at low temperatures. This is accomplished through the use of the Tomonaga - Luttinger density fluctuation description of the electron gas. The many body effects of the impurity on thermodynamic properties, Cooper-pair formation, the electronic density of states, and the local magnetic susceptibility are discussed. Also included is an analysis of the palladium/hydrogen-deuterium system in the light of this model. It is found that the model is able to account for the inverse isotope effect. Dissert. Abstr.

N77-23959 California Univ., San Diego.
APPLICATIONS OF THE THEORY OF THE INHOMOGENEOUS ELECTRON GAS: A NEW CALCULATIONAL TECHNIQUE Ph.D. Thesis
James Harold Rose, Jr. 1976 131 p
Avail: Univ. Microfilms Order No. 77-4220

The ground state surface properties of simple metals and the electron hole liquid in Ge are calculated. A calculation technique (the variation of potentials technique) for implementing the density functional formalism is presented. The technique yields results which are fully equivalent to solving the Kohn-Sham self consistent equation formulation of the density functional formalism. Several problems are presented which illustrate the use of the technique: (1) the determination of a partial phase diagram for a possible condensed phase of Li impurities in Si;

(2) the ground state surface properties of the electron hole liquid; (3) the extinction of infrared radiation by a cloud of electron hole liquid droplets; (4) the effect of nonlocal contributions to exchange and correlation for the surface properties of simple metals; (5) the nonlinear static response of the electron gas to a proton; and (6) the ground state energy and density of the H(-) ion. Dissert. Abstr.

N77-23960 Northwestern Univ., Evanston, Ill.
PHOTOEXCITATION IN SUPERCONDUCTORS Ph.D. Thesis
Ivan Kohn Schuller 1976 142 p
Avail: Univ. Microfilms Order No. 77-1344

The behavior of superconductors under light illumination was studied. The acoustical coupling of two thin superconducting films forming a tunnel junction was measured. The experiment was performed by photoexciting quasiparticles in one film and studying the resulting charge in the energy gap. A detailed comparison shows agreement of the experimental results with Little's theory of the acoustical coupling of solids. In addition, the results indicate that the acoustic coupling of a thin lead film to the helium bath is much stronger than to the underlying tin film and substrate. The relaxation time of the superconducting energy gap was also measured. It was shown that the relaxation time diverges near the superconducting transition temperature. It was also found that the equilibrium energy gap does not obey the BCS temperature dependence near the transition temperature. This result was attributed to inhomogeneities in the films. Dissert. Abstr.

N77-23961 Princeton Univ., N. J.
EXACT AND APPROXIMATE THEORIES OF VIBRATIONS OF PIEZOELECTRIC CRYSTAL PLATES Ph.D. Thesis
Stavros Syngellakis 1976 144 p
Avail: Univ. Microfilms Order No. 77-4801

The formal exact solution of the equations of linear piezoelectricity for plates with triclinic symmetry is obtained for plane waves propagating in an arbitrary direction in the plane of the plate. An infinite set of two-dimensional field equations for anisotropic plates are deduced from the three-dimensional variational principle of piezoelectricity by expanding the mechanical displacement and the electric potential in trigonometric series. By a truncation procedure, equations of various orders of approximation were extracted from the infinite set. For each truncated system, the plate kinetic energy and the plate electric enthalpy are formulated; a theorem for the uniqueness of solutions is proved and the orthogonality of modes of free vibrations is established. Dissert. Abstr.

N77-23962 California Univ., Berkeley.
STRUCTURAL QUESTIONS CONCERNING COMMUTATIVE LATTICES OF INVARIANT SUBSPACES AND THEIR ASSOCIATED OPERATOR ALGEBRAS Ph.D. Thesis
Cecelia Laurie Bleecker 1976 48 p
Avail: Univ. Microfilms Order No. 77-4382

The structure of L and of alg L, the algebra of all operators which leaves each element of L invariant, and the structure of alg L where L is a commutative subspace lattice is discussed. Results indicate that any commutative subspace lattice L can be represented as certain multiplication operators on L(2) (X,m) for some compact separable metric space X and some finite regular Borel measure m, and if L is a lattice of width n, i.e., L is generated by n chains or totally ordered subspace lattices, then L can be represented as certain multiplication operators on L(2) ([o,1]n, m) for some finite Borel measure m. Sufficient lattice theoretic conditions are given on a commutative subspace lattice L of finite width to insure the existence of Hilbert-Schmidt operators in alg L and the existence of an approximate identity of Hilbert-Schmidt operators in alg L. Dissert. Abstr.

N77-23963 California Univ., Berkeley.
SECONDARY ELECTRON EMISSION IN SOLIDS Ph.D. Thesis
Michael Shing-Che Chung 1976 257 p
Avail: Univ. Microfilms Order No. 77-4421

A theoretical model of Secondary Electron Emission (SEE) in the Nearly-Free-Electron (NFE) metals was developed. An algorithm is given for calculating the external secondary electron energy distribution curves (EDC's) due to various excitation processes. Calculations of the EDC's are presented for Al, Mg, Na, and K for incident primary energies in the keV range. In all cases, the EDC resulting from volume plasmon decay represents by far the dominant contribution to the total EDC. Dissert. Abstr.

N77-23964*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE FOURTH POSITIVE SYSTEM OF CARBON MONOXIDE
Robert L. Kurucz 30 Nov. 1976 174 p refs
(Grant NsG-7054)
(NASA-CR-152700; SAO-Special-Rept-374) Avail: NTIS HC A08/MF A01 CSCL 20/12

Tables of energy levels, Franck-Condon factors, r-centroids, transition moments, line wavelengths, and gf values are presented for the fourth positive system of CO. Author

N77-23965*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
BULK AND THIN FILMS OF FeTe: A MOESSBAUER STUDY
W. T. Escue, Kamma Aggarwal (Indian Inst. of Technology, Delhi), and R. G. Mendiratta (Indian Inst. of Technology, Delhi) Feb. 1977 30 p refs
(NASA-TM-X-73380) Avail: NTIS HC A03/MF A01 CSCL 20L

Studies of bulk and thin films of FeTe using Moessbauer spectroscopy showed that FeTe has one noncubic Fe (+2) site which is 3d2 4s 4p3 hybridized. The presence of dangling bands was indicated in spectra of FeTe thin films. The films showed a tendency of texture formation. The substrate was observed to influence the film structure and nature of bonds in films. Author

N77-23966*# Texas Univ., El Paso.
ESR STUDIES OF THE SLOW TUMBLING OF VANADYL SPIN PROBES IN NEMATIC LIQUID CRYSTALS Interim Progress Report
Michael P. Eastman, Gerald V. Bruno, and Juan O. Lawson Mar. 1977 15 p refs
(Grant NsG-1316)
(NASA-CR-145201) Avail: NTIS HC A02/MF A01 CSCL 20L

ESR line shapes that are appropriate for slowly tumbling vanadyl spin probes in viscous nematic liquid crystals were calculated by the stochastic Liouville method. Because of the symmetry possessed by vanadyl, the analysis and interpretation of these line shapes was simplified considerably. Spectral line shapes agreed well with experimental spectra of VOAcAc in the nematic liquid crystal Phase V and BEPC. Deviations from Brownian rotational diffusion were noted. A slowly fluctuating torque analysis yielded good agreement with the experimental spectra. Author

N77-23967# North Carolina State Univ., Raleigh. Dept. of Nuclear Engineering.
DIFFUSION OF GASES IN SOLIDS: RARE GAS DIFFUSION IN SOLIDS; TRITIUM DIFFUSION IN FISSION AND FUSION REACTOR METALS Final Report
P. M. Abraham, D. Chandra, J. M. Mintz, T. S. Elleman, and K. Verghese 1976 118 p refs
(Contract E(40-1)-3508)
(ORO-3508-10) Avail: NTIS HC A06/MF A01

The materials were austenitic stainless steels, Zircaloy, and niobium. In all three of the metal systems investigated, tritium release rates were found to be inhibited by surface oxide films. The effective diffusion coefficients that control tritium release from surface films on Zircaloy and niobium were determined to be eight to ten orders of magnitude lower than the bulk diffusion coefficients. A rapid component of diffusion due to grain boundaries was identified in stainless steels. The grain boundary diffusion coefficient was determined to be about six orders of magnitude greater than the bulk diffusion coefficient for tritium in stainless steel. In Zircaloy clad fuel pins, the permeation rate of tritium through the cladding is rate-limited by the extremely slow diffusion rate in the surface films. Tritium diffusion rates through surface oxide films on niobium appear to be controlled by cracks in the surface films at temperatures up to 600 C.ERA

N77-23968# Cornell Univ., Ithaca, N.Y. Materials Science Center.
GLASSY LOW TEMPERATURE THERMAL PROPERTIES IN CRYSTALLINE SOLIDS M.S. Thesis
Bernard David Nathan May 1976 119 p refs Sponsored in part by ARPA
(Contract E(11-1)-3151)
(COO-3151-67) Avail: NTIS HC A06/MF A01

Amorphous dielectrics are known to exhibit anomalous low temperature properties. An extensive review of these properties is presented with an eye toward an understanding of low-lying excitation modes thought to exist in glasses. Work on these systems is described in which a Zr-20 percent Nb sample which would be expected to reduce and redistribute the proposed tunneling states. The thermal conductivity becomes similar to that of a quenched Zr-8 percent Nb sample and the excess specific heat linear in temperature dependence is reduced to half the value found in quenched Zr-20 percent Nb. The coefficient of the T3 term in the specific heat unexpectedly increased from 23.3 to 56.9 erg/g K4 and this is attributed to a softening of the lattice due to annealing. The specific heat of this sample was remeasured after it was dunked in liquid nitrogen. The cubic term was then found to be 19.5 erg/g K4 smaller than that in quenched Zr-20 percent Nb, an effect which was expected due to the chemical diffusion during annealing. ERA

N77-23969# Brookhaven National Lab., Upton, N.Y.
CRITICAL SCATTERING FROM STRUCTURAL PHASE TRANSITIONS ASSOCIATED WITH A HOMOGENEOUS DEFORMATION OF THE CRYSTAL
R. A. Cowley (Edinburgh Univ., Scotland) 1976 6 p refs Presented at the Conf. on Neutron Scattering, Gatlinburgh, Tenn., 6 Jun. 1976
(Contract E(30-1)-16)
(BNL-21405; Conf-760601-2) Avail: NTIS HC A02/MF A01

At many structural phase transitions, the order parameter is linearly coupled to the acoustic modes of vibration as in the piezoelectric ferroelectric, KDP. One effect of this coupling is to reduce the effect of the critical fluctuations so that classical Landau theory is a good description of the transition. In addition, if both the order parameter and the acoustic modes scatter neutrons coherently, there will be interference effects which may lead to a complex asymmetric pattern of critical scattering. Calculations of this effect for DKDP give good agreement with experimental results. ERA

N77-23970# California Univ., Berkeley. Lawrence Berkeley Lab.
EXCITED STATE ENERGY TRANSFER STUDIES USING ELECTRON SPIN COHERENCE
John Conarroe Brock 3 Jun. 1976 178 p refs
(Contract W-7405-eng-48)
(LBL-5189) Avail: NTIS HC A09/MF A01

Equations detailing the time evolution of a coherently coupled two-level system are presented and developed to include the effects of feeding and decay processes on coherence induced in an excited state ensemble. Various mechanisms responsible for a loss of phase coherence in an excited state ensemble are identified and discussed, including the effects of energy exchange between systems that are not translationally equivalent. Also described is electron spin ordering, a new approach for examining electronically excited states. A model incorporating kinetic features of excited state ensembles is developed to characterize the decay of the ordered state for both on and off resonance applications. Spinlocking and electron spin ordering are used to study exciton transport between localized isotopic impurit states via the one-dimensional triplet exciton band of 1,2,4,5 d2-tetrachlorobenzene. ERA

N77-23971# State Univ. of New York, Stony Brook.
THEORY OF THE LATTICE DYNAMICS OF MODEL CRYSTALS CONTAINING SCREW DISLOCATIONS Ph.D. Thesis
N. E. Glass Aug. 1976 164 p refs
(Contract AT-(11-1)-3476)
(COO-3476-13) Avail: NTIS HC A08/MF A01

The perturbation matrix of a single screw dislocation is determined and is used with the perfect lattice Green function to find four secular equations for the frequencies altered by the dislocation. The solutions yield, depending on the model parameters, up to four separate bands of optic localized-modes across the Brillouin zone. No shifts in the perfect lattice acoustical bands are found. The frequencies of the dislocation-induced localized modes are well separated from the frequencies of the perfect lattice modes and should present no difficulty in being distinguished experimentally. The Green function of the lattice containing many parallel screw dislocations is determined by following the method in use for point defects. With this imperfect-lattice Green function, the neutron cross-section for coherent one-phonon inelastic scattering by the dislocation localized-modes is obtained. The most important parameter is found to be the ratio of longitudinal (lambda) to the transverse force constants. ERA

N77-23972# Illinois Univ., Chicago. Dept. of Chemistry.
OPTICAL DETECTION OF ULTRASOUND IN PARAMAGNETIC CRYSTALS Final Report
A. H. Francis and A. I. Attia May 1976 50 p refs
(Contract F33615-73-C-5048)
(AD-A032181; AFML-TR-76-57) Avail: NTIS HC A03/MF A01 CSCL 17/8

Optical detection methods were employed to investigate the interaction of applied coherent phonons with the excited state spin system of molecular crystals. Results are reported and discussed concerning both single and double quantum resonant interactions as well as phonon-nuclear quadrupole interactions and non-resonant spin-phonon interactions. GRA

N77-23973# California Univ., Davis. Dept. of Physics.
EXPERIMENTAL AND THEORETICAL STUDY OF THE OPTICAL AND ELECTRONIC PROPERTIES OF SEMICONDUCTORS AND TRANSITION METAL COMPOUNDS Final Report
C. Y. Fong and Frederick Wooten 30 Aug. 1976 19 p refs
(Grant AF-AFOSR-2353-72)
(AD-A032996; AFOSR-76-1136TR) Avail: NTIS HC A02/MF A01 CSCL 11/6

The optical reflectivities of face-centered-cubic TiC, ZrC, TiN, and ZrN have been measured in the range 0.1-h bar omega-8.0eV. Subsequently, the electronic-energy-band structure for these compounds have been calculated using a modified empirical-pseudopotential method, and the structures in the reflectivities derived from these band structures show one-to-one correspondence to the structures in the experimental data; the agreement is to within 0.2eV. The charge distribution of these transition metal compounds were then calculated using the wave functions of the EPM calculations. GRA

N77-23974# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DEPTH-RESOLVED CATHODOLUMINESCENCE ON THE EFFECTS OF Cd IMPLANTATION AND ANNEALING IN GALLIUM ARSENIDE M.S. Thesis
Joseph D. Dumoulin Dec. 1976 76 p refs
(AD-A034029; GEP/PH/76-2) Avail: NTIS HC A05/MF A01 CSCL 20/12

Ten samples of GaAs were examined by depth-resolved cathodoluminescence at temperatures of 10 K and 80 K. Electron beam energies from 1.0KV to 25KV were used. Both cold and hot, 135KV, Cd-implanted GaAs samples with Si3N4 caps were studied. A sample of the n-type GaAs substrate was used as a control. Spectra were obtained showing the ion implantation damage layers. The unannealed samples damage layer boundaries were calculated at 0.01 micrometers, 0.24 micrometers, 0.37 micrometers, and 0.61 micrometers for fluences of 10 to the 12th power ion/sq cm, 10 to the 14th power ion/sq cm, 10 to the 15th power ion/sq cm, and 10 to the 16th power ion/sq cm respectively. For fluences = or > 10 to the 14th power ion/sq cm and 800 C, 15 minute anneal in flowing argon gas was not sufficient to completely remove the damage layer. An emission peak at 1.488eV changed in energy by only 0.001 eV between 10 K and 80 K, and was assigned to a donor-Cd acceptor recombination. A peak approximately 0.010eV above the band gap energy was observed in many of the implanted samples. Peaks at 1.4eV, 1.41eV, 1.39eV, and 1.35eV increased in intensity upon annealing and were assigned to vacancies,

which were enhanced during annealing. The major conclusion reached was that depth-resolved cathodoluminescence was an excellent non-destructive method of sharply defining damage layers produced by ion implantation. Author (GRA)

N77-23975# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DETERMINING IMPURITIES IN GALLIUM PHOSPHIDE BY ANALYZING CATHODOLUMINESCENCE M.S. Thesis
James C. Slavicek Dec. 1976 76 p refs
(AD-A034002; GEP/PH/76-9) Avail: NTIS HC A05/MF A01 CSCL 20/12

The cathodoluminescence emission spectra of four GaP samples, three grown by a liquid phase epitaxial(LPE) process and the fourth bulk solution grown(BSG), was studied in order to identify impurities present in the samples. The samples were excited by a 20 kV, 1.0 microampere electron beam; and the spectra, photoelectrically detected, were recorded at various sample temperatures between 8 K and 100 K using liquid helium and liquid nitrogen as coolants. The impurities, identified by comparison with the literature, were S, N, C, Si, and O. In addition, two of the samples showed the presence of Cu although only one sample was intentionally Cu doped. The cathodoluminescence procedure was found to be as sensitive and effective as the photoluminescence procedure in detecting impurities, and the LPE process appeared to produce the purest samples.
Author (GRA)

N77-23976# California Univ., La Jolla. Dept. of Physics.
THEORY OF SHALLOW DONOR STATES WITH A STRONG CENTRAL CELL PERTURBATION Ph.D. Thesis
Joan R. Onffroy Nov. 1976 19 p refs
(Contract N00014-76-C-0050)
(AD-A032570; TR-38) Avail: NTIS HC A02/MF A01 CSCL 20/12

A new theory for shallow donor states with a strong central cell perturbation is presented. The impurity wave function is expanded in terms of generalized Wannier functions, equivalent to the eigenfunctions of the periodic lattice with the strong central cell perturbing potential. The single unknown parameter of this theory can be fitted by comparison with the observed binding energy. The theory is applied to the impurity states of As, P, and Sb in Silicon. The Fermi contact constants for the Si29 lattice nuclei surrounding the impurity are calculated and compared to the ENDOR experiments of Hale and Mieher and to recent calculations, using a different method, by Ivey and Mieher. Some elucidations of the theory of Ivey and Mieher are offered. In contrast to the conclusions of these authors, it is found that a suitable form of the Effective Mass Theory can account for the observations within an accuracy of about 10-15 percent.
Author (GRA)

N77-23977# International Business Machines Corp., Hopewell Junction, N.Y. East Fishkill Lab.
DEFECT STRUCTURE IN GaAs Final Report, 1 Jun. 1975 - 31 May 1976
Guenter H. Schwuttke Sep. 1976 98 p refs
(Contract F19628-75-C-0174; AF Proj. 5620)
(AD-A032697; IBM-TR-22.2065; RADC-TR-76-256) Avail: NTIS HC A05/MF A01 CSCL 20/2

A unified computer program is presented, which is useful for the generation of indexed Kossel, pseudo-Kossel, Kikuchi, and channeling maps. The application of Impact Sound Stressing, a novel technique to introduce damage into wafer surfaces, is discussed for GaAs. Equipment and operational parameters are given. Impact Sound Stress induced damage in GaAs surfaces is characterized by light optical and scanning electron microscopy. Author (GRA)

N77-23978# Pennsylvania State Univ., University Park. Materials Research Lab.
PIEZO-OPTIC PROPERTIES OF LIQUIDS UNDER HIGH PRESSURE Annual Summary Report, 1 Jan. - 31 Dec. 1976
K. Vedam 15 Dec. 1976 30 p refs
(Contract N00014-75-C-0915)
(AD-A033565; MRL-KV-76-1) Avail: NTIS HC A03/MF A01 CSCL 20/3

A high pressure liquid cell interferometer to measure the variation of refractive index of liquids with pressure to 14 kbars is described. The amount of liquid needed is only 3 c.c. Interferometric measurements on a number of liquids, at high pressure show (I) first experimental proof that the Eulerian frame-indifferent analogue strain E is a more useful strain measure than the Lagrangian strain, (II) Keane's equation of state best describes each and all liquids, studied, (III) change in refractive index vs E is linear for all liquids even though the volume strain involved is as high as 33 percent. Author (GRA)

N77-23979# Utah Univ., Salt Lake City. Coll. of Engineering.
METATROPIC MATERIALS: A THEORY FOR PERMANENT MEMORY EFFECTS Final Report, Apr. 1972 - Jul. 1976
J. E. Fitzgerald and R. Rubenstein Aug. 1976 104 p refs
Prepared in cooperation with Ga. Inst. of Technol.
(Grant AF-AFOSR-2322-72; AF Proj. 2307)
(AD-A032849; SCEGIT-76-130; AFOSR-76-1184TR) Avail: NTIS HC A06/MF A01 CSCL 20/2

This sets forth a 3-dimensional theory of permanent memory effects, metatropic materials, applicable to heterogeneous solids. The change in the value of the various moduli as well as the changes in the isotropy group, i.e. crystal class, of the stress response caused by a past sequence of strain histories is given a general structure. The nature and sign of the residual stresses, permanent set, and the isotropy group are deduced from an operational definition of metatropic effects. These include damage effects, strain hardening, and aging. GRA

N77-23980# Harry Diamond Labs., Adelphi, Md.
RARE EARTH ION-HOST LATTICE INTERACTIONS. 8: LANTHANIDES IN YPO4
Nick Karayianis, Clyde A. Morrison, and Donald E. Wortman Aug. 1976 23 p refs
(DA Proj. 1T1-61102-AH-46)
(AD-A033901; HDL-TR-1776) Avail: NTIS MF A01 CSCL 20/5

Even-fold crystal-field parameters (even-k B sub km) were found that gave least rms deviations of less than 10/cm between calculated and measured energy levels for Nd(3-) and Ho(3-) in YPO4. Linear interpolation and extrapolation yielded even-k B sub km for the triply ionized lanthanides Pr through Tm in YPO4. Energy levels predicted with these B sub km for Er, Tm, and Eu were in close agreement with measured energy levels for these ions. Crystal-field components (A sub km) were determined by a sum over the YPO4 lattice. These A sub km were used with appropriate B sub km, radial integrals, and energy positions of the higher electronic configurations to calculate squared matrix elements of the electric dipole operator between the Stark split energy states of the ground configuration for the triply ionized lanthanides in YPO4. Author (GRA)

N77-23981# Harry Diamond Labs., Adelphi, Md.
RARE EARTH ION-HOST LATTICE INTERACTIONS. 6: LANTHANIDES IN LiYF4
Donald E. Wortman, Nick Karayianis, and Clyde A. Morrison Aug. 1976 142 p refs
(DA Proj. 1T1-61102-AH46; HDL Proj. 308637)
(AD-A033902; HDL-TR-1770) Avail: NTIS MF A01 CSCL 20/5

Phenomenological even-fold crystal field parameters, B sub km, for S4 site symmetry are determined that yield least rms deviations between calculated and measured energy levels for Nd(3-), Ho(3-), and Er(3-) in LiYF4. Crystal field components, A sub km, are determined by a sum over the LiYF4 lattice, and B sub km are calculated for the lanthanides in this material. These parameters are used with appropriate radial integrals and energy positions of the higher electronic configurations to calculate squared-matrix elements of the electric dipole operator between the Stark split energy states of the ground configurations for the triply ionized lanthanides in LiYF4. Author (GRA)

N77-23982# Wake Forest Univ., Winston-Salem, N.C.
RELAXATION AND DIFFUSION IN DOPED LEAD CRYSTALS Final Report, 1 Mar. 1973 - 11 Sep. 1976
Thomas J. Turner 11 Sep. 1976 13 p refs Submitted for publication

(Grants DA-ARO(D)-31-124-73-G140; DAHC04-75-G-0126) (AD-A034721; ARO-11285.2-MC) Avail: NTIS HC A02/MF A01 CSCL 11/6

This investigation was initiated to determine the nature and cause of four relaxation peaks which occur in single crystals of lead doped with one of the noble metals, gold, silver, or copper. In the case of each of these dopants, studies employing a composite oscillator have revealed a dominant internal friction peak which had the ideal Debye shape and which yielded an activation energy equal to that given in the literature for the diffusion of the particular noble metal into lead. Author (GRA)

N77-23983# Notre Dame Univ., Ind. Dept. of Metallurgical Engineering and Materials Science.
MAGNETIZATION, MAGNETOCRYSTALLINE ANISOTROPY AND MAGNETOSTRICTION IN SOME RARE-EARTH-COBALT COMPOUNDS, R2o17
A. E. Miller, C. W. Allen, T. Dsilva, H. L. Rodrigues, and K. C. Liao Dec. 1976 26 p refs
(Contract N00014-75-C-0977)
(AD-A034681; TR-12-76) Avail: NTIS HC A03/MF A01 CSCL 20/12

The saturation magnetization, magnetization curves in the easy and hard directions, and the magnetostriction constant were determined from 77.4 K to 400K on single crystals of terbium cobalt, homium cobalt, erbium cobalt. The anisotropy constant was determined by least square fit of the theoretical magnetization to the measured magnetization curve along the hard axis. The magnetostriction coefficient was determined by the strain gage technique. Author

N77-23984# Mississippi Valley State Univ., Itta Bena.
ELECTROREFLECTANCE, FARADAY ROTATION AND HALL EFFECT OF INFRARED DETECTOR MATERIALS Final Report, Jul. 1974 - Jul. 1976
S. A. Khan and H. Piller (La. State Univ., Baton Rouge.) Jul. 1976 59 p refs
(Contract N00019-74-C-0503)
(AD-A034089) Avail: NTIS HC A04/MF A01 CSCL 17/5

The purpose of this research is to obtain the knowledge of microscopic parameters in the alloy semiconductor Pb(1-x)sn(x)Te from the combined electrical and optical properties. Studies of the surface properties and the optical properties will provide information which will lead to an improvement of the performance of infrared detectors and laser devices. GRA

N77-23985# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
ON THE DISSOCIATION AND REACTIVITY OF HYDROGEN AT LOW-COORDINATION TRANSITION-METAL SITES Interim Report
K. H. Johnson and A. Balazs 11 Jan. 1977 14 p refs
(Contract N00014-75-C-0970)
(AD-A034514; TR-3) Avail: NTIS HC A02/MF A01 CSCL 07/2

The electronic structure of 'coordinatively unsaturated' transition-metal complexes, in conjunction with the concept of orbital electronegativity, suggests how such complexes, along with low-coordination sites on transition-metal clusters and surfaces, can act as centers for the dissociation and reactivity of H2. Author (GRA)

N77-23986# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
ATOMIC TRANSPORT AND TRANSFORMATION BEHAVIOR IN METALLIC GLASSES Interim Report
Frans Spaepen and David Turnbull Dec. 1976 27 p refs
(Contract N00014-67-C-0020; Grant NSF DMR-76-01111)
(AD-A034512; TR-1) Avail: NTIS HC A03/MF A01 CSCL 11/2

Glasses, metallic or non-metallic, are in states which are configurationally frozen and less stable than some crystallized states. Upon annealing glasses may relax configurationally without transforming and then phase separate and/or crystallize. In this paper the atomic transport behavior in metallic glasses as manifested by their flow, relaxation and transformation behavior is surveyed. The rate constant for flow, k(eta), of a glass may be regarded as a product of a 'jump' factor and a configurational excitation factor. The activation energy for jumping or isoconfigurational flow, of a metallic glass is only a small fraction, of order 1/10 or less, of the apparent activation energy for flow of the fully relaxed melt in the glass transition range. In configurationally relaxed metallic glasses, the rate constants for phase transformations scale as k(eta) and appear to be controlled by the rate of impurity redistribution. In some configurationally unrelaxed systems, the indicated rates of diffusive transport persist for periods much longer than those expected for configurational relaxation. Some possible explanations for this behavior are discussed. Author (GRA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N77-23987 Princeton Univ., N. J.
QUANTUM SOLITONS IN TWO DIMENSIONAL FIELD THEORIES Ph.D. Thesis
Thomas N. Tudron 1976 114 p
Avail: Univ. Microfilms Order No. 77-4802

The mass of the lambda phi to the fourth power soliton through the second quantum correction is calculated in the Lagrangian path integral method due to Callan and Gross, in the Hamiltonian path integral formalism of Gervais, Jevicki, and Sakita, and in the canonical theory devised by Tomboulis. The subtraction of the vacuum energy and the renormalization of the soliton mass are presented. Comparisons of the various formulations are undertaken and it is proven that the Lagrangian and Hamiltonian path integral approaches are exactly equivalent and that the canonical method of Tomboulis is equivalent to that of Christ and Lee. Finally, the recent modification to the path integral quantization of the soliton due to Gervais and Jevicki is briefly discussed. Dissert. Abstr.

N77-23988 Michigan State Univ., East Lansing.
THE EFFECT OF INTERNAL NUCLEON MOTION AND NUCLEAR BINDING ON ELASTIC PION-NUCLEUS SCATTERING Ph.D. Thesis
Kenneth Edward Gilbert 1976 254 p
Avail: Univ. Microfilms Order No. 77-5802

Elastic pion-nucleus scattering was studied at energies near the pion-nucleon (3,3) resonance. Specifically, the effect of internal nucleon motion and nuclear binding on resonant elastic pion-nucleus scattering was studied. The nuclei considered were He-4, C-12, and O-16. The basic approach used was to first calculate the effects using exact numerical methods and then to develop analytic approximations which take into account the main features of the numerical results. In all cases, an optical potential was obtained which contains no adjustable parameters.
Dissert. Abstr.

N77-23989 Wisconsin Univ., Madison.
THE MOMENTUM DISTRIBUTION AND VAN HOVE FUNCTION IN LOW DENSITY QUANTUM SYSTEMS Ph.D. Thesis
David Harry Berman 1976 175 p
Avail: Univ. Microfilms Order No. 76-28139

Formal density expansions of the momentum distribution and intermediate scattering functions in quantum systems are derived by the method of Ramshaw. Coefficients of terms linear in the density, two-body quantum clusters, are shown to be finite for a wide class of potentials. The two-body cluster for the momentum distribution is computed using a Lennard-Jones potential with He-4 parameters at 1K, 2K, and 4K. Effects of the interaction on the direct and exchange terms of the resulting momentum distribution are contrasted. Using the same potential, the first five time derivatives of the self part of the intermediate scattering function are calculated at 1K and 4K. The relationship of the Van Hove function to high momentum transfer scattering

processes is examined to determine the role of the momentum distribution. Dissert. Abstr.

N77-23990 California Univ., Berkeley.
CERTAIN RESTRICTIONS ON THE GLOBAL STRUCTURE OF SPACETIMES IN GENERAL RELATIVITY Ph.D. Thesis
Robert Donald Budic 1976 65 p
Avail: Univ. Microfilms Order No. 77-4392

Deterministic spacetimes are defined. Deterministic spacetimes can be characterized by the existence of a unique past ideal point; the boundary of the past of each observer is a compact Cauchy surface for the spacetime and the Lorentz volume of the past defines a family of C(1) scalar functions with a unique timelike gradient. The causal completion and causal boundary of a (causally continuous) spacetime are defined and for any deterministic spacetime the causal completion is metrizable. The extension of these results to more general and, perhaps, more realistic spacetimes, asymptotically deterministic and weakly asymptotically deterministic spacetimes, is discussed. A refinement of the Cosmic Censorship Hypothesis is suggested. Dissert. Abstr.

N77-23991 Delaware Univ., Newark.
INSTANTANEOUS ACTION-AT-A-DISTANCE FORMULATION OF QUANTUM ELECTRODYNAMICS Ph.D. Thesis
Pisith Vora-Singha 1977 87 p
Avail: Univ. Microfilms Order No. 77-4241

Energy, linear momentum, angular momentum and the center of mass constant, which are computed from Kerner's symmetric joint Lagrangian, are interpreted quantum mechanically in Heisenberg representation. The energy, when expanded and truncated after the 1 sq c term, has interaction terms with the sign opposite to the interaction term in the Darwin Hamiltonian. When interpreted quantum mechanically, the energy (up to the 1 sq c term) and the Darwin Hamiltonian are called the Modified-Breit and Breit operators, respectively. The total energy, when interpreted quantum mechanically, is called the energy operator. The three operators are applied to plane wave scattering, He2P fine structure splitting and positronium. Dissert. Abstr.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N77-23992 George Washington Univ., Washington, D.C.
A GENERAL SYSTEMS MODEL FOR MEASURING ORGANIZATIONAL EFFECTIVENESS Ph.D. Thesis
Willis Harold Martin, Jr. 1976 164 p
Avail: Univ. Microfilms Order No. 77-6006

Selected functions of general systems theory were used to develop a model to measure organizational effectiveness as determined by managers in selected organizations. Prior to developing the model, a taxonomy for structuring organizational activities was developed. Three hierarchical structures were examined for applicability. These structures are referred to by the strategy used in their development and are identified as (1) reductionist, (2) temporal, and (3) morphological structure. A modification of the morphological structure led to the categorization by the functioning characteristics of an organization. Viewing an organization as an adaptive system and applying general systems theory led to the definition of the generalized functioning characteristics of (1) adaptive self-stabilization, (2) adaptive self organization, (3) growth, (4) differentiation, (5) control, and (6) competition. Dissert. Abstr.

N77-23993# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
INNOVATION AND PRODUCTIVITY IN RESEARCH AND DEVELOPMENT: SOME ASSOCIATED INDIVIDUAL AND ORGANIZATIONAL VARIABLES
Michael J. Stahl May 1976 283 p refs
(AD-A032273; AFIT-TR-76-10) Avail: NTIS HC A13/MF A01 CSCL 05/10

The relationships of organizational variables with innovation and productivity of scientists and engineers in R and D laboratories were explored. Peer ratings of innovation (original and useful output) and productivity (quantity of output) were utilized as criterion. Information was obtained on 154 scientists/engineers in 35 work groups in three Air Force R and D laboratories. Significant relationships found between organizational variables and innovation and productivity included: rewards for innovation, communication on technical matters with other scientists/engineers within the work group, and an age-education demographic group of variables. Level of participation in goal setting and group leader's level of empathy were also consistently related to level of productivity. GRA

N77-23994# Army Materiel Development And Readiness Command, Alexandria, Va.
A PROPOSED R AND D MANAGEMENT MODEL
Robert F. Chaillet and Herman W. Mies Dec. 1976 46 p
(AD-A033099) Avail: NTIS HC A03/MF A01 CSCL 05/2

This report describes a proposal that would account for the resources used to perform basic research and exploratory development within the Department of Defense. It describes a means by which research and development managers can determine the output being derived from the resources expended. The proposed system could be implemented with minor changes to existing regulatory reporting requirements. No new DOD reporting forms would be required for the proposed system. Author (GRA)

N77-23995# Defense Systems Management School, Fort Belvoir, Va.
LIFE CYCLE MANAGEMENT OF ARMY TACTICAL MANAGEMENT INFORMATION SYSTEMS (TACMIS)
Mack C. Ward 13 May 1976 28 p refs
(AD-A032499) Avail: NTIS HC A03/MF A01 CSCL 05/1

The purpose of this study is to examine the life cycle management of Army Tactical Management Information Systems with particular emphasis on integration of the requirements of the Life Cycle System Management Model (LCSMM) for Army Systems, DA Pam 11-25, and the Army Management Information System (AMIS) AR 18-1. Considerable attention, both in the literature and in practice, has been given to the systems acquisition process for inception through development into production. The principal thrust of this attention, however, has been directed towards RDT and E and acquisition of weapons systems to counter a perceived threat. This study focuses on areas in the present AMIS Model that appear to be weak and attempts to correlate some of the more significant activities and documentation requirements with the LCSMM. The end result of this effort is the determination of the feasibility of developing a single Army TACMIS model with the detail of the LCSMM. Author (GRA)

N77-23996# Naval Postgraduate School, Monterey, Calif.
THE USE OF INSIGHT IN MANAGEMENT DECISIONS M.S. Thesis
Sorrell Berman Sep. 1976 54 p refs
(AD-A033696) Avail: NTIS HC A04/MF A01 CSCL 05/10

This thesis hypothesizes that insight is the key element in effective decision-making. It approaches this position by developing a basic model of the environment in which the manager functions, showing the resources at his disposal. It then describes the contributions of the technologies which form the knowledge base for decision-making. Next, it distinguishes between intuition and insight, and demonstrates that it is insight which is the basis for the effective manager's art. GRA

N77-23997# Defense Systems Management School, Fort Belvoir, Va.
INDEPENDENT RESEARCH AND DEVELOPMENT ISSUES AND ALTERNATIVES

Michael F. Salata 16 May 1976 59 p refs
(AD-A033954) Avail: NTIS HC A04/MF A01 CSCL 05/1

Independent research and development (IR/D) is contractor technical effort not sponsored by or required in the performance of a Government contract. DoD Directive 5100.66 states the policy for recovery of contractors costs and outlines the procedures for administration of contractor initiated R/D effort. Controversy over the DOD policy centers around 2 points: (1) the value of IR/D to the Government considering the expenditure involved; and (2) the appropriateness of the present method of recovery of costs considering other possible alternatives. This report seeks: to determine what was perceived as the value of the DOD IR/D program; and, with some knowledge of the current administrative policy for IR/D, to determine the proposed alternatives and how they are perceived. This report includes a discussion centering around the benefits of IR/D definition of various proposed alternative recovery methods for IR/D costs, and an evaluation of these methods by the parties involved in this controversial program. GRA

N77-23998# Defense Systems Management School, Fort Belvoir, Va.

A SYSTEMS APPROACH TO INTEGRATING FUTURE MANUFACTURING TECHNOLOGY WITH THE MUNITIONS PRODUCTION BASE MODERNIZATION PLANNING

Douglas T. Mears May 1976 34 p refs
(AD-A033817) Avail: NTIS HC A03/MF A01 CSCL 05/1

The report is the result of interviews with key U.S. Army agencies involved in manufacturing methods technology planning and forecasting. The result was an interactive on-line computer system that integrates a projected U.S. Army Development and Readiness Command Manufacturing Technology Plan with the existing U.S. Army Project Manager for Munitions Production Base Modernization and Expansion Integrated Engineering Plan. The system would provide the latest as well as known and projected Manufacturing methods and technology projects categorized by technology areas. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N77-23999*# California Univ., Davis. Dept. of Electrical Engineering.

DEVELOPMENT OF A CHARACTER, LINE AND POINT DISPLAY SYSTEM Final Report

E. W. Owen Mar. 1977 36 p refs
(Contract NAS9-14696)
(NASA-CR-151355) Avail: NTIS HC A03/MF A01 CSCL 05B

A compact graphics terminal for use as the input to a computerized medical records system is described. The principal mode of communication between the terminal and the records system is by checklists and menu selection. However, the terminal accepts short, handwritten messages as well as conventional alphanumeric input. The terminal consists of an electronic tablet, a display, a microcomputer controller, a character generator, and a refresh memory for the display. An Intel SBC 80/10 microcomputer controls the flow of information and a 16 kilobyte memory stores the point-by-point array of information to be displayed. A specially designed interface continuously generates the raster display without the intervention of the microcomputer. Author

N77-24000# Zentralstelle fuer Luftfahrtdokumentation und Information, Munich (West Germany).

CONFERENCE REPORTS AERONAUTICS, ASTRONAUTICS, SPACE RESEARCH, NO. 1 1976

1976 164 p
Avail: NTIS MF A01; HC Avail: Issuing Activity

The first issue of a monthly abstract journal covering conference papers in the field of aerospace sciences and engineering, is presented. The aims of this journal are to provide rapid dissemination of the most recent results in research and development, indicate trends, stimulate new ideas, and promote the exchange of information. The journal consists of a bibliographical part and several indexes, namely by conference, author, report number, subject and corporate author. The bibliographical description follows the rules of the International Nuclear Information System (INIS). The subject description is based on the NASA subject categories, and on keywords selected from the document title. ESA

N77-24001# Wisconsin Univ., Madison. Mathematics Research Center.

ON PERFORMANCE MODELLING OF DATA BASE MANAGEMENT SYSTEMS: AN INDUCTIVE APPROACH Summary Report

Allen Reiter Jul. 1976 46 p refs
(Contract DAAG29-75-0024)
(AD-A031959; MRC-TSR-1648) Avail: NTIS HC A03/MF A01 CSCL 05/8

This paper describes a simulation model in which user jobs are synthesized from basic building blocks. The modelling process consists of three stages: translation from a user view of data and processes dependent on the data base management system (DMS) into a standard form consisting of explicit access paths over logical data structures; translation of the logical structures and operations into block-oriented structures and operations on a virtual machine; and execution of a number of concurrent jobs on a real machine. This paper deals only with the last two stages. Standard forms for the logical structures and operations and for the virtual machine are described; they are as free as possible from the data view of the particular DMS. A generalized modelling framework, which becomes a model of a particular DMS when various 'plug-in' modules are added is described.. The data representation features of a DMS enter as parameters for the second stage, while the resource management tactics are the parameters for the last stage. The proposed model structure is intended as a basis for DMS design experiments.

Author (GRA)

N77-24002# Qei, Inc., Bedford, Mass.

FACTORS IN THE PLANNING OF A NATIONAL INFORMATION SYSTEM FOR RENEWABLE ENERGY Final Report

J. W. Kuipers, R. W. Thorpe, and F. W. Lancaster 30 Jun. 1976 224 p refs
(Grant NSF SIS-75-12766)
(PB-262003/7; Rept-6930) Avail: NTIS HC A10/MF A01 CSCL 05B

A national information system for the renewable energy field is proposed. The system is intended to serve the scientific and technical communities as well as the management, technology, industrial, policy making, and the general public components of the energy field. It is proposed that in order to achieve improvements in communication between information communities and within communities, a system be set up which comprises a distributed network of satellite centers with a coordinating headquarters center. Satellite centers in the system consist of Information Resource and Analysis Centers (IRACs) for particular information areas. IRACs are to be designated for each defined information area in the energy fields of interest and are to be responsible for acquiring, organizing and maintaining all information of interest in a given area. GRA

N77-24003# Naval Postgraduate School, Monterey, Calif.

DEMONSTRATION OF THE FEASIBILITY OF AUTOMATING THE INFORMATION SYSTEM OF A SMALL SERVICE ORGANIZATION USING A GENERALIZED COMPUTER SOFTWARE M.S. Thesis

Kenneth M. Suess and James F. Thaler Sep. 1976 201 p refs
(AD-A033694; NPS-54CF76091) Avail: NTIS HC A10/MF A01 CSCL 05/2

The concept of using a generalized computer software package to satisfy the information processing requirements of a small service organization was introduced. The feasibility of this approach was demonstrated by applying the Statistical Package for the Social Sciences (SPSS) to the data processing requirements of

a service organization. Using SPSS, an automated information system was developed and implemented in an operational environment for the Facility Engineering Support Office (FESO), a service organization at the Civil Engineering Laboratory (CEL). The development process and operating procedures were documented to facilitate the adoption of this approach by other service organizations. GRA

N77-24004# National Bureau of Standards, Washington, D. C.
TECHNICAL PROFILE OF SEVEN DATA ELEMENT DICTIONARY/DIRECTORY SYSTEMS
Belkis Leong-Hong and Beatrice Marron Feb. 1977 49 p refs
(PB-263177/8; NBS-SP-500-3; LC-76-58915) Avail: NTIS HC A03/MF A01 CSCL 09B

Data element dictionary directories (DED/D) are described and their application in the control and uniform management of data elements is discussed. Existing systems are described and classified. Technical features are presented for seven commercially available systems. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N77-24005# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AIRCRAFT AIRFRAME COST ESTIMATION UTILIZING A COMPONENTS OF VARIANCE MODEL M.S. Thesis
Ronald C. Marcotte Oct. 1976 99 p refs
(AD-A032627; GOR/SM/76D-10) Avail: NTIS HC A05/MF A01 CSCL 05/1

Previous studies into airframe acquisition cost estimation do not explicitly recognize the existence of correlation in the historical data. If one believes this data problem exists, then it is possible to develop a components of variance model that takes the problem into account. It is a more general model that recognizes two sources of error: (1) error due to different types of airframes and (2) overall or ordinary regression error. The variance of these two errors can be estimated and then can be utilized along with the technique of generalized least squares to obtain a cost estimating relationship which explicitly accounts for the data correlation. This modeling technique, when compared to techniques presently in service, shows that present estimating relationships underestimate the variance of the cost prediction of a new type airframe and overestimate the variance of the cost prediction of a follow-on airframe. Also, those existing techniques which implicitly recognize data correlation do not make use of all the data information available and therefore produce estimates with poor confidence prediction intervals. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N77-24006# Committee on Appropriations (U. S. House).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, INDEPENDENT AGENCIES APPROPRIATIONS FOR 1978. PART 5: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington GPO 1977 1619 p refs Hearings before a subcomm. of the Comm. on Appropriations, 95th Congr., 1st Sess., 29 Mar. 1977
(GPO-88-190) Avail: Comm. on Appropriations

The hearings concerning the NASA appropriations are reported. Programs discussed include space flight, space science, space applications, aeronautics, shuttle payloads, and technology utilization. F.O.S.

N77-24007# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1977
Washington GPO 1977 340 p Index for hearings on H.R. 11573 (superseded by H.R. 12453) before Comm. on Sci. and Technol., 94th Congr., 2d Sess., 1977
(GPO-80-649) Avail: Comm. on Sci. and Technol.

Subject and personal author indexes to the 1977 NASA Authorization Hearings and an explanation of how to use the indexes and divider pages for each part is presented. Author

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N77-24008 California Univ., Berkeley.
ENERGY RECOVERY THROUGH BIOGASIFICATION OF MUNICIPAL SOLID WASTES AND UTILIZATION OF THERMAL WASTES FROM AN ENERGY-URBAN-AGRO-WASTE COMPLEX Ph.D. Thesis
Luis Florentino Diaz 1976 254 p
Avail: Univ. Microfilms Order No. 77-4347

Experiments on the anaerobic digestion of the organic fraction of municipal refuse were performed. Objective of the experiments was to stabilize and simultaneously produce a fuel from a particular fraction of the municipal solid waste. The scale of the experiments ranged from laboratory (4 to 9 liter) cultures to small pilot plant (1600 liter) digesters. The refuse used as feed was enriched by the addition of raw sewage sludge in various ratios. Organic loading rates ranged from 0.067 to 0.4 lbs VS/cu ft 3 -day. Typical hydraulic detention times were 15 and 30 days. Temperatures were kept within the range of 85 F to 105 F. Digestion efficiency was based on energy conversion and gas production. A simulation study was also conducted in which energy derived from solid waste conversion and from thermal waste discharges was used to meet certain energy requirements of an energy-urban-agro-waste complex. In the study, a community was integrated with its electric generating station, wastewater treatment plant, refuse processing plant, and food production facilities. Dissert. Abstr.

N77-24009*# Southeastern Oklahoma State Univ., Durant. Technology Use Studies Center.
TECHNOLOGY UTILIZATION IN A NON-URBAN REGION: FURTHER IMPACT AND TECHNIQUE OF THE TECHNOLOGY USE STUDIES CENTER
Dec. 1976 102 p refs
(Contract NASw-2881)
(NASA-CR-152842) Avail: NTIS HC A06/MF A01 CSCL 05B

Updated information is given pertaining to Technology Use Studies Center (TUSC) clients who are those that receive/use information as disseminated by the center. The client information is presented as a continuation of client data as set forth in the center's previous annual report. Author

N77-24010*# National Aeronautics and Space Administration, Washington, D. C.
FY 1978 AERONAUTICS AND SPACE TECHNOLOGY PROGRAM SUMMARY Statement Before the Committee on Commerce, Science, and Transportation, United States Senate
7 Mar. 1977 123 p
(NASA-TM-X-74687) Avail: NTIS HC A06/MF A01 CSCL 05B

Highlights of the aeronautics program include research on aircraft energy efficiency, supersonic cruise aircraft, vertical takeoff and landing aircraft, short haul/short takeoff and landing aircraft, and general aviation aircraft. The space technology program

includes work on space structures, propulsion systems, power systems, materials, and electronics. D.M.L.

N77-24011*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NASA TECHNOLOGY UTILIZATION HOUSE TECHNICAL SUPPORT PACKAGE
[1976] 43 p
(NASA-TM-X-74686) Avail: NTIS HC A03/MF A01 CSCL 13M

Special systems and features incorporated in the NASA Technology Utilization House are described. These include solar energy utilization, energy conservation techniques, water recycling, hot water systems, security systems, and other design features. D.M.L.

N77-24012# Canadian Aeronautics and Space Inst., Montreal (Quebec).
PROCEEDINGS OF THE 10TH CANADIAN SYMPOSIUM ON AIR CUSHION TECHNOLOGY
Ottawa Natl. Res. Council of Canada Jan. 1977 185 p refs (TR-2-77) Avail: NTIS HC A09/MF A01; Natl. Res. Council of Canada, $6.00

The present status of air cushion technology and its applications in Canada and the United Kingdom are examined. Developments discussed include hovercraft stability on water, skirt material wear at low temperature, and a U.S./Canadian full scale program on air cushion landing gear for aircraft. Applications described include overland transport and inland ferries, icebreaking, and marine operations. Author

N77-24013# Central Technical Inst. TNO, Apeldoorn (Netherlands).
INVESTIGATION INTO THE APPLICATION OF PHYSICO-CHEMICAL PROCESSES FOR MUNICIPAL WASTE-WATER TREATMENT
May 1975 87 p refs In DUTCH; ENGLISH summary
(TDCK-67878) Avail: NTIS HC A05/MF A01

A literature review of physico-chemical domestic waste water treatment processes is presented. Evaluation of physico-chemical and of biological waste water treatment techniques showed that the physico-chemical treatment in its present state of development is not an attractive alternative for the biological treatment. The total of fixed and variable costs for the physico-chemical method is estimated to be equal to or higher than that for the biological treatment. Physico-chemical treatment offers possibilities for waste water that is toxic to biological systems. Also biological treatment plants can be relieved of part of their load by applying a physico-chemical pre-treatment (coagulation/flocculation). ESA

N77-24014# Naval Postgraduate School, Monterey, Calif.
UTILIZATION OF TECHNOLOGY TRANSFER CONCEPTS AS AN AID FOR ENGINEERING MANAGEMENT IN A TEST AND EVALUATION ORGANIZATION M.S. Thesis
Jack A. Grubber Sep. 1976 135 p refs
(AD-A033697; NPS-54CF76093) Avail: NTIS HC A07/MF A01 CSCL 05/2

This thesis addresses Technology Transfer as it might be applied in a Test and Evaluation (T and E) activity for weapons systems and components within the Federal Government. Factors associated with the technology transfer process, aids and barriers to technology transfer, the innovative and creative processes, and managerial requirements for technology transfer are related to the job of an engineering manager in a T and E organization. From the relationships, a paradigm for action for middle management engineers to improve technical capability by utilizing technology transfer concepts is formulated. GRA

N77-24015# Naval Postgraduate School, Monterey, Calif.
A STUDY OF THE EFFECTIVENESS OF SYMPOSIA FOR TRANSFERRING TECHNICAL INFORMATION TO APPLIED END USE M.S. Thesis.
Donald R. Bennett, John L. Sweeney, and Kenneth L. Thornton Sep. 1976 128 p refs
(AD-A033692; NPS-54CF76095) Avail: NTIS HC A07/MF A01 CSCL 05/2

A program is designed for the transfer of technology from the Navy's research effort to other potential users. This program uses the technical symposium as the basic mechanism for transfer, drawing on the technological resources of research organizations and the perceived needs of the user community. It is designed to communicate technological information, to develop a mutual appreciation of each other's problems and to establish communications among all participants in the technology utilization process. A plan is developed for a technology transfer symposium in the field of Communications Electronics based on promising research efforts in this field performed at the Naval Postgraduate School. This symposium is proposed as the prototype vehicle for the Navy's Technology Transfer Symposium Program. Lastly, a technique is developed for measuring the effectiveness of the symposium program utilizing feed back from preceding symposia so that the format of the Technology Transfer Symposium Program can be optimized. GRA

N77-24016# Lake Charles-McNeese Urban Observatory, La.
SOLID WASTE DISPOSAL AND RESOURCE RECOVERY
Victor Monsour, Charles M. Fontenot, and Anand S. Katiyar Jul. 1976 55 p refs
(Contract HUD-H-2196)
(PB-262860/0; UO-LCCM-LAC-76-004) Avail: NTIS HC A04/MF A01 CSCL 13B

The city of Lake Charles examined several alternatives to its present method of curbside solid waste collection using the usual two-way containers and garbage trucks with three-man crews. It was shown that a one-man garbage truck, where only one-way containers were used, could cover a standard route in the same amount of time as the three-man crews where two-way containers were used. Limited trials with source separation and separate collection of newspapers was good. There was little or no added cost for separate collection, a market was found to dispose of the paper, and, on that particular route, garbage volume going to the landfill was reduced considerably. GRA

N77-24017# Environmental Protection Agency, Washington, D. C. Office of Toxic Substances.
CONSIDERATIONS RELATING TO TOXIC SUBSTANCES IN THE APPLICATION OF MUNICIPAL SLUDGE TO CROPLAND AND PASTURELAND (A BACKGROUND SUMMARY) Final Report
Frank D. Kover Nov. 1976 30 p refs
(PB-263006/9; EPA-560/8-76-004) Avail: NTIS HC A03/MF A01 CSCL 13B

Background information is presented, pertinent to an assessment of the potential health hazards from toxic substances when disposing/utilizing municipal sludge on agricultural lands, particularly croplands and pasturelands where products enter the human food chain. GRA

N77-24018# National Academy of Sciences - National Research Council, Washington, D. C.
TECHNOLOGY TRANSFER FROM FOREIGN DIRECT INVESTMENT IN THE UNITED STATES. REPORT OF A SEMINAR SERIES Final Report
1976 77 p refs Seminars held in New York, 2-5 Feb. 1976 Sponsored in part by Commerce Dept.
(Contract NSF C-310; Grant NSF PRA-76-15037)
(PB-263012/7; NSF/PRA-7615037-1-77) Avail: NTIS HC A05/MF A01 CSCL 05A

Four sectors of industry were studied to determine the impact of direct foreign investment on technology transfer. No significant net technology outflow was observed in the manufacturing of petrochemicals, pharmaceuticals, non-electric machinery, electronics and computers, or scientific instruments. GRA

N77-24019# Pratt (R. H.) Associates, Inc., Kensington, Md.
THE POTENTIAL FOR TRANSIT AS AN ENERGY SAVING OPTION Final Report
Phillip S. Shapiro and Richard H. Pratt Mar. 1976 109 p refs
(Contract FEA-CO-04-50077-00)
(PB-263087/9; FEA/D-76/224) Avail: NTIS HC A06/MF A01 CSCL 13B

The potential impacts and energy efficiencies of short-term policies designed to induce auto drivers to shift to public transit were studied. An analysis is made of the energy efficiencies of

various urban passenger transportation modes, including automobile, bus, rapid rail, commuter rail, and Dial-A-Ride transit. Policies to induce mode shifts to public transit are structured into alternative scenarios for evaluation. Possible urbanized area transportation energy savings as well as reductions in vehicle miles of travel are estimated first for individual representative cities and then expanded to a national level. Representative cost evaluations of policy actions are included as well. Finally, note is made of projected secondary or indirect impacts of policy design and implementation. GRA

N77-24020# Reichhold Chemicals, Inc., Tuscaloosa, Ala.
TREATMENT AND DISPOSAL OF COMPLEX INDUSTRIAL WASTES Final Report, Sep. 1970 - Feb. 1974
C. Schimmel and D. B. Griffin Nov. 1976 192 p Sponsored by EPA, Geological Survey, Alabama and Alabama State Oil and Gas Board
(PB-262979/8; EPA-600/2-76-123) Avail: NTIS HC A09/MF A01 CSCL 07A

The waste effluent from operation of the Tuscaloosa, Alabama, plant of Reichhold Chemicals, Inc., results from both batch and continuous operations, contains both organic and inorganic wastes and varies both in composition and concentration. The development of a bio-oxidation process is described which resulted in a significant reduction in BOD5 and COD loading and almost complete removal of phenols. Lack of reliability ascribed to the bio process led to development of an activated carbon adsorption process that has resulted in the average removal of 90 percent of the COD, 75 percent of the BOD5 and over 99 percent of the phenol lead in the RCI process waste. Bio-oxidation should not be overlooked for treating industrial wastes although its usefulness is limited with respect to bacterial poisons, as henol, and by ambient temperature changes that results in variable biological activity. GRA

N77-24021# Syracuse Research Corp., N. Y.
ADOPTION AND UTILIZATION OF URBAN TECHNOLOGY: A DECISION-MAKING STUDY. ANALYSIS AND CONCLUSIONS Interim Report
W. Henry Lambright Jan. 1977 185 p refs
(Grant NSF RDA-75-19704)
(PB-263251/1; TR-77-503; NSF/PRA-7519704-1-7) Avail: NTIS HC A09/MF A01 CSCL 05K

The organizational problem-solving process model provides a framework for analysis as to how and why new technologies are utilized or rejected by local governments. It suggests that innovation occurs over stages with the pace and direction of innovation depending upon the capacity of local entrepreneurs to bring about coalitions of support sufficient to overcome whatever barriers may stand in the way of the technology. It points the investigator toward an attempt to understand who is involved in utilization, at which stage, and with what linkages to other organizations. Decision-making in innovation is indeed a problem-solving process. The problem to be solved is two-fold: (1) to choose a technology that meets an organizational need; and (2) to steer the chosen solution through the constraints lying in the path of routine use. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N77-24022 California Univ., Berkeley.
AN INVESTIGATION OF THE SMR PHENOMENON IN F AND G DWARF STARS IN THE SOLAR NEIGHBORHOOD Ph.D. Thesis
Malcolm Isaac Raff 1976 122 p
Avail: Univ. Microfilms Order No. 77-4576

Abundance analyses were made from coude spectrograms of 25 F and G dwarf stars selected from 300 candidates by photoelectric spectrum scanner observations of the Na-D lines and the Halpha-line. An objective, computerized analysis of these spectrograms provided unbiased equivalent widths of nearly 140 lines of 11 elements for each star. With T sub eff obtained from the scanner observations of the strength of H alpha, a scaled Bilderberg model atmosphere was employed to obtain M/H abundances relative to the sun. Several conclusions are suggested regarding the characteristics of the stars evaluated. Dissert. Abstr.

N77-24023 California Univ., Berkeley.
CARBON MONOXIDE ABUNDANCES AND C12/C13 RATIOS OF K AND M STARS OBTAINED WITH AN ECHELLE SPECTROMETER Ph.D. Thesis
Gordon Clark Augason 1976 179 p
Avail: Univ. Microfilms Order No. 77-4367

The spectra of 5 K and M stars in the 4200-4300/cm region were obtained by using a scanning echelle spectrometer. Although the spectrometer was not optimized for the 120 in. telescope, spectra of sufficient quality were obtained to derive CO molecular column densities and C12/C13 isotope ratios in the stellar atmospheres. The spectra were analyzed by means of a multilevel synthetic spectrum program which used unpublished model atmospheres. Terrestrial atmospheric compensation was accomplished by means of a synthetic spectrum program. The H2O line parameters were taken from existing sources. The CH4 line parameters were determined for the first time. For the stellar computations, a new table of CO line parameters at high temperatures was derived. Dissert. Abstr.

N77-24024*# AiResearch Mfg. Co., Los Angeles, Calif.
PRELIMINARY DESIGN STUDY OF ASTRONOMICAL DETECTOR COOLING SYSTEM
R. H. Norman 17 Nov. 1976 74 p
(Contract NAS2-8984)
(NASA-CR-151979) Avail: NTIS HC A04/MF A01 CSCL 03A

The preliminary design of an astronomical detector cooling system for possible use in the NASA C-141 Airborne Infrared Observatory is presented. The system consists of the following elements: supercritical helium tank, Joule-Thomson supply gas conditioner, Joule-Thomson expander (JTX), optical cavity dewar, optical cavity temperature controller, adjustable J-T discharge gas pressure controller, and vacuum pump. Author

N77-24025*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A1540-53, AN ECLIPSING X-RAY BINARY PULSATOR
R. H. Becker, J. H. Swank, E. A. Boldt, S. S. Holt, S. H. Pravdo, J. R. Saba, and P. J. Serlemitsos May 1977 15 p refs Submitted for publication
(NASA-TM-X-71301; X-661-77-42) Avail: NTIS HC A02/MF A01 CSCL 03A

An eclipsing X-ray binary pulsator consistent with the location of A1540-53 was observed. The source pulse period was 528.93 plus or minus 0.10 seconds. The binary nature is confirmed by a Doppler curve for the pulsation period. The eclipse angle of 30.5 deg plus or minus 3 deg and the 4 h transition to and from eclipse suggest an early type, giant or supergiant, primary star. Author

N77-24026*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTRAL CHARACTERISTICS OF 3U1915-05, A BURST SOURCE CANDIDATE
R. H. Becker, B. W. Smith, J. H. Swank, E. A. Boldt, S. S. Holt, S. H. Pravdo (Md. Univ. College Park), and P. J. Serlemitsos Apr. 1977 13 p refs Submitted for publication
(NASA-TM-X-71302; X-661-77-86) Avail: NTIS HC A02/MF A01 CSCL 03A

An X-ray burst source was discovered near the X-ray source 3U1915-05. The continuum spectra of both the burst source and the quiescent 3U1915-05 are hard, with kT above 20 keV.

The spectrum of 3U1915-05 has a feature at 9.1 keV, which, if attributed to absorption by hydrogen and helium-like iron, suggests the presence of a highly ionized cloud surrounding a central X-ray source. Author

N77-24027*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
LINE BLANKETING IN VEGA AND SIRUS Final Report
Robert L. Kurucz [1976] 69 p refs
(Grant NsG-5030)
(NASA-CR-153055) Avail: NTIS HC A04/MF A01 CSCL 03A

A theoretical model and spectrum calculation for Vega is discussed. The abundance of carbon is approximately -3.8, which is 0.3 lower than the old solar value and supports Mount and Linsky's newer value. The oxygen abundance is approximately -3.5. Assuming that Vega has solar abundances, the solar oxygen abundance appears to have been overestimated by 0.3 in the log. Other abundances appear to be solar. For Sirius the calculations do not agree with the observed spectrum. Line opacity is considerably underestimated, notably in third-spectrum iron group lines. Carbon is underabundant relative to Vega by 0.2 in the log. Nitrogen is unchanged. Oxygen is enhanced by 0.3. Heavier elements are enhanced by 1.0 in the log. Calibration yields 1.3E-10 ergs/sq cm/s/nm for each U1 Copernicus count at 130 nm. Author

N77-24028# Texas Univ., Austin. Center for Particle Theory.
POSSIBILITY OF STABLE QUARK STARS
R. L. Bowers, A. M. Gleeson, and R. D. Pedigo Aug. 1976 42 p refs
(Contract E(40-1)-3992)
(ORO-3992-277) Avail: NTIS HC A03/MF A01

A recent zero temperature equation of state which contains quark-partons separated from conventional baryons by a phase transition is used to investigate the stability of quark stars. The sensitivity to the physics is also considered. The conclusions, which are found to be relatively model independent, indicate that a separately identifiable class of stable objects called quark stars does not exist. ERA

N77-24029# Texas Univ., Austin. Center for Particle Theory.
MODEL OF INTERACTING NEUTRON MATTER AT POST SUPERNOVA COLLAPSE TEMPERATURES
R. L. Bowers, A. M. Gleeson, and J. W. Wheeler Aug. 1976 15 p
(Contract E(40-1)-3992)
(ORO-3992-268) Avail: NTIS HC A02/MF A01

A model of hot, strongly interacting matter is presented which is relativistic both in its description of the interactions and in its inclusions of finite density and temperature effects. This model is fit to nuclear matter and was used to construct model neutron stars whose masses and moments of inertia are in excellent agreement with observational data on pulsars and compact X-ray sources. Extensive numerical results are presented which bridge the temperature and density interval separating current models of supernova remnants as predicted by evolutionary calculations based on ideal gas equations of state and the final configurations of cold neutron stars. ERA

N77-24030# Cambridge Univ. (England). Inst. of Astronomy.
[RESEARCH ACTIVITIES OF THE INSTITUTE OF ASTRONOMY] Annual Report, period ending 31 Aug. 1976
1976 21 p refs
Avail: NTIS HC A02/MF A01

Topics covered are observations of galaxies and stars and theoretical aspects of galaxies, cosmology, and stars. The Institute's instrumentation is described. ESA

N77-24031# European Space Research and Technology Center, Noordwijk (Netherlands).
THE FAINT OBJECT CAMERA
. Macchetto and R. J. Laurance Paris ESA Mar. 1977 4 p
SA-SN-126) Avail: NTIS HC A03/MF A01

The NASA 2.4 m Space Telescope (ST) will be an earth-biting astronomical observatory which will make a dominant ntribution to the understanding of the content, structure, scale, and evolution of the universe. ESA's contribution to this project will include the Faint Object Camera (FOC) one of the four axial instruments carried by the ST. The FOC is an imaging camera provided with a photon-counting detector which will fully exploit the near diffraction-limited performance of the ST and will be able to detect objects 50 times fainter than those observable with the most powerful earthbound telescope. The scientific rationale, the design, and the performance expectations of the FOC are described. Author (ESA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N77-24032 Princeton Univ., N. J.
INTERNAL GRAVITY WAVES IN THE NOCTURNAL PLANETARY BOUNDARY LAYER Ph.D. Thesis
Richard Rotunno 1976 132 p
Avail: Univ. Microfilms Order No. 77-4797

During the transition period between daytime and nighttime conditions, the mean stability increases greatly. Because the existing internal wave theory did not cover the circumstances encountered in the nocturnal planetary boundary layer, an appropriate theory was developed. The major result is that for internal gravity waves propagating in a time-varying stratification (produced by heat transfer rather than by the mean deformation of the velocity field) the product of the wave energy and frequency is conserved. The effect of wind veering upon internal gravity waves was determined and the trapeze instability investigated in a mean shear flow. The decay of large-amplitude eddies after sunset was studied. Dissert. Abstr.

N77-24033 California Univ., Santa Barbara.
ROUNDS ON THE MASS AND THE MOMENT OF INERTIA OF NON-ROTATING NEUTRON STARS Ph.D. Thesis
Augusto Gianni Sabbadini 1976 182 p
Avail: Univ. Microfilms Order No. 77-5246

Bounds were placed on the mass and the moment of inertia of relativistic, spherical, perfect fluid neutron stars, under minimal assumptions on the equation of state of neutron star matter above nuclear densities. The assumptions were that the pressure p, the density rho, and the derivative dp/drho are positive. The equation of state was assumed to be known below the density rho = 5x10 to the 14th power g/cu cm. The upper bound on the mass of a nonrotating neutron star, under these assumptions, was found to be 5 M solar massed. Upper and lower bounds on the moment of inertia were derived for: (1) a spherical star of given mass and radius (without assuming a specific equation of state in any density region); (2) a spherical neutron star of arbitrary mass and radius; and (3) a spherical neutron star of given mass. Dissert. Abstr.

N77-24034 California Univ., Berkeley.
THE MEASUREMENT OF THE MASSES OF THE NEUTRON STAR, Her X-1, AND ITS BINARY COMPANION, HZ Her, AS DERIVED FROM THE STUDY OF 1.24-SECOND OPTICAL PULSATIONS FROM THE REVERSIBLE REACTION HZ Her EQUALS Her X-1 BINARY SYSTEM AND THE X-RAY-TO-OPTICAL REPROCESSING REFLECTION AND TRANSMISSION MECHANISMS Ph.D. Thesis
John Middleditch 1976 336 p
Avail: Univ. Microfilms Order No. 77-4538

Intermittent optical pulsations at the 0.1 to 0.3 percent level were detected from this binary system in over 500 hours of optical observations. These pulsations are present only for well defined values of the 1.7-day (binary) and 35-day phases. Positions of the pulsation-emitting regions, projected onto the orbital plane, were measured, and three distinct regions were resolved. A simple model is put forth which accounts for the observed binary behavior, which gives a direct determination of the mass ratio and which establishes that the spin of the pulsar is prograde. Additionally it is shown that HZ Her fills its critical Roche lobe.

Dissert. Abstr.

N77-24035 California Univ., Berkeley.
THE SOURCES AND ACCELERATION OF LOW ENERGY PROTONS AND ELECTRONS OBSERVED IN INTERPLANETARY SPACE Ph.D. Thesis
Robert Edward McGuire 1976 225 p
Avail: Univ. Microfilms Order No. 77-4521

Instruments on the linar orbiting Apollo 15 and 16 spacecraft were used to measure electron planetary space. The quiet time and average spectra of interplanetary electrons and protons were constructed and shown to be similar in slope. The contributions to average interplanetary particle fluxes were analyzed. The dominance of solar particles in the average fluxes was demonstrated and combined with the similarity in spectral shapes to argue for the solar origin of quiet time fluxes. The existence of two separate electron populations above and below 2 keV was shown. A procedure for the numerical solution of the cosmic ray transport equation was applied to match the energy dependent time histories of particles flux in the 1 September 1971 flare event and to derive the probable shapes of electron and proton injection spectra near the sun. Dissert. Abstr.

N77-24036 Princeton Univ., N. J.
A MEASUREMENT OF THE EXTRAGALACTIC BACKGROUND LIGHT Ph.D. Thesis
Roger Raymond Dube 1976 118 p
Avail: Univ. Microfilms Order No. 77-6029

An experiment to measure the intensity of the extragalactic background light at lambda = 5175 A near the galactic polar regions was performed at Kitt Peak National Observatory and at Cerro Tololo Interamerican Observatory. Good data were obtained on six nights in which three fields were observed per night, and five zenith angles were observed per field. The zodiacal light was removed from the data and was used to obtain a map of the zodiacal light in ecliptic coordinates. The zodiacal light map is in good agreement with recent space measurements. The zodiacal light intensity was typically 100 S10 units (n. of 10th magnitude stars/square degree), and could be measured with an accuracy of 10 percent/zenith angle. The zenith airglow intensity was typically 30 plus or minus S10. The intensity of the extragalactic background light at lambda = 5000 A was found to be (0.9 plus or minus 1.3) S10. The results indicate that the mean luminosity density due to galaxies is low, and that there is no evidence for hidden luminous matter, such as dwarf galaxies. Dissert. Abstr.

N77-24037 Cornell Univ., Ithaca, N.Y.
ROCKET INFRARED SPECTROSCOPY OF THE ZODIACAL DUST CLOUD Ph.D. Thesis
Daniel Anthony Briotta, Jr. 1976 86 p
Avail: Univ. Microfilms Order No. 77-5727

The 8-14 micron infrared spectrum of the zodiacal dust cloud was measured with a liquid helium cooled array spectrometer and telescope from an altitude of approximately 300 km. A good scan across the ecliptic plane at a solar elongation of approximately 103 was obtained. The spectrum shows a pronounced silicate emission feature similar to that seen in carbonaceous chondrites and in the Orion Nebula, along with a dilute underlying blackbody. The shape of the silicate feature indicates a typical grain size of the order of 5 microns, although larger blackbody grains and possibly smaller, hotter silicate grains may also contribute to the emission. The dilutions are consistent with the particle and mass densities observed by spacecraft. The temperatures are reasonable for the blackbody grains (R approximately 300 K), but require a strong greenhouse effect for the smaller particles producing the silicate feature (T approximately 375 K). Dissert. Abstr.

N77-24038*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE CONTRIBUTION OF INTERSTELLAR PARTICLES TO THE INTERPLANETARY DUST COMPLEX
Gilmer Allen Gary Jan. 1977 33 p refs
(NASA-TM-X-73377) Avail: NTIS HC A03/MF A01 CSCL 03B

The Poynting-Robertson effect acting on interstellar particles passing by the sun was shown to have the potential to capture and possibly to contribute some of these particles to the interplanetary dust complex. When the probability of encounter of the sun with interstellar clouds is considered, the quasi-equilibrium mass rate of accretion by this mechanism is comparable to the mass loss rate of the interplanetary complex. The mechanism then produces a quasi-equilibrium condition to maintain the interplanetary particle complex. This requires that the interstellar particles have a repulsive force due to radiation pressure less than the attractive gravitational force. If this assumption is correct for a significant fraction of the particles, then at intervals an interstellar cloud may pass sufficiently close to the sun to allow the Poynting-Robertson effect to replenish the interplanetary complex. The previously proposed mechanisms of gravitational encounters and the solar gravitational lens as a method of capture of interstellar particles are shown to be insufficient. Corrections to the formulations of these two methods are given, and a closed form formula of the Poynting-Robertson effect on hyperbolic orbits about a star is derived. Author

N77-24039*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ADIABATIC PARTICLE MOTION IN A NEARLY DRIFT-FREE MAGNETIC FIELD: APPLICATION TO THE GEOMAGNETIC TAIL
David P. Stern Apr. 1977 42 p refs Submitted for publication
(NASA-TM-X-71310; X-602-77-89) Avail: NTIS HC A03/MF A01 CSCL 03B

The guiding center motion of particles in a nearly drift free magnetic field is analyzed in order to investigate the dependence of mean drift velocity on equatorial pitch angle, the variation of local drift velocity along the trajectory, and other properties. The mean drift for adiabatic particles is expressed by means of elliptic integrals. Approximations to the twice-averaged Hamiltonian W near z = 0 are derived, permitting simple representation of drift paths if an electric potential also exists. In addition, the use of W or of expressions for the longitudinal invariant allows the derivation of the twice averaged Liouville equation and of the corresponding Vlasov equation. Bounce times are calculated (using the drift-free approximation), as are instantaneous guiding center drift velocities, which are then used to provide a numerical check on the formulas for the mean drift. Author

N77-24040*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
OBSERVATIONS OF ION CYCLOTRON WAVES WITHIN THE PLASMASPHERE BY HAWKEYE-1 Progress Report
Paul M. Kintner and Donald A. Gurnett Dec. 1976 27 p refs Submitted for publication
(Contract NAS1-13129; Grant NGL-16-001-043; Contract N00014-76-C-0016)
(NASA-CR-152840; AD-A034783; U-of-Iowa-76-35) Avail: NTIS HC A03/MF A01 CSCL 04/1

A survey of the plasma wave data from the Hawkeye-1 spacecraft has been performed in search of ion cyclotron waves associated with the scattering and loss of ring current ions within and near the plasma-pause. During an 18 month period, consisting of about 270 orbits, a total of 5 events have been found with clearly detectable electric and magnetic fields at frequencies below the proton gyrofrequency. Comparisons of the electric and magnetic field amplitudes for these events provide strong evidence that these waves are ion cyclotron waves. All five events occurred during the recovery phase of a magnetic storm at radial distances within or very close to the plasmapause boundary. The results of this survey confirm and are consistent with the earlier identification of ion cyclotron waves by the Explorer 45 satellite. The Hawkeye-1 observations show that ion cyclotron waves of substantial amplitude occur at magnetic latitudes well away from the magnetic equator. GRA

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology: and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N77-24041*# National Aeronautics and Space Administration, Washington, D. C.
REPORTS OF PLANETARY GEOLOGY PROGRAM, 1976 - 1977
Raymond Arvidson, comp. and Russell Wahmann, comp. May 1977 303 p
(NASA-TM-X-3511) Avail: NTIS HC A14/MF A01 CSCL 03B

One hundred seventeen investigations undertaken in the NASA Planetary Geology Program in 1976-1977 are reported in abstract form. Topics discussed include solar system formation; planetary interiors; planetary evolution; asteroids, comets and moons; cratering; volcanic, eolian, fluvial and mass wasting processes; volatiles and the Martian regolith; mapping; and instrument development and techniques. An author index is provided. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N77-24042 California Univ., San Diego.
MEASUREMENTS OF THE SOLAR WIND VELOCITY AND COMPACT RADIO SOURCE STRUCTURE FROM 74-MHz INTERPLANETARY SCINTILLATIONS Ph.D. Thesis
John Jay Kaufman 1976 202 p
Avail: Univ. Microfilms Order No. 77-4213

Interplanetary scintillations (IPS) were measured at 74 MHz using the UCSD solar wind observatory the measurements were used to compare and evaluate different methods for inferring the solar wind velocity from IPS and to study the structure of several strong, compact radio sources. Dissert. Abstr.

N77-24043 California Univ., Berkeley.
RADIO FREQUENCY PROBING OF THE SOLAR CORONA Ph.D. Thesis
Angus Robert Cannon 1976 437 p
Avail: Univ. Microfilms Order No. 77-4399

The effects of the coronal plasma on the telemetry carrier signals of the deep-space probes Pioneer 9, Mariner 9, and Pioneer 10 during their superior conjunctions with the sun were observed. The relationships of these effects to various solar features were investigated; a sequence of solar microwave observations was conducted to assist in the establishment of such relationships. The results were used to help evaluate the effects of the solar activity cycle on spacecraft communications. The prediction of the various coronal effects during future superior conjunctions of interplanetary spacecraft with the sun is discussed. Some elementary aspects of the theoretical interpretation of the experimental measurements in terms of the fundamental properties of the coronal plasma are considered. Dissert. Abstr.

N77-24044# Air Force Geophysics Lab., Hanscom AFB, Mass.
THE SAGAMORE HILL SWEEP FREQUENCY INTERFEROMETRIC RADIOMETER USED FOR SOLAR STUDIES IN THE DEKAMETRIC BAND
D. N. Gaunt 23 Aug. 1976 44 p
(AF Proj. 4643)
(AD-A033651; AFGL-TR-76-0194; AFGL-IP-248) Avail: NTIS HC A03/MF A01 CSCL 09/3

A sweep frequency interferometer covering the 25 to 75 MHz range at Sagamore Hill is described. The basic principles of sweep frequency interferometry are discussed. This report also describes the use and design of a Bicone antenna system, phase detector, and fringe width modulation technique-all developed at Sagamore Hill. The types of solar burst activity resolved with the system are reviewed. Author (GRA)

N77-24045# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NO. 388. PART 1: PROMPT REPORTS. DATA FOR NOVEMBER 1976 - OCTOBER 1976
Hope I. Leighton Dec. 1976 121 p 2 Vol.
(PB-264163/7; SGD-388-Pt-1; NOAA-77012503-Pt-1) Avail: NTIS HC A06/MF A01 CSCL 03B

Solar activity data gathered by Pioneer 6 and SMS-2 GOES satellite are presented in tables and graphs. Also included are indexes for sudden ionospheric disturbances, solar radio waves, cosmic rays, geomagnetism, and radio propagation. GRA

N77-24046# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NO. 388. PART 2: COMPREHENSIVE REPORTS. DATA FOR JUNE 1976 - MAY 1976 AND MISCELLANEA
Hope I. Leighton Dec. 1976 35 p refs 2 Vol.
(PB-264164/5; SGD-388-Pt-2; NOAA-77012504-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 03B

Information recorded by Explorer satellites is presented in tables and graphs. Data provided include solar flares, solar radio waves, abbreviated calendar record, regional flare index, and a synoptic chart. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N77-24047 Princeton Univ., N. J.
MODELS FOR EXTRAGALACTIC DOUBLE RADIO SOURCES Ph.D. Thesis
Paul Joseph Witta 1976 308 p
Avail: Univ. Microfilms Order No. 77-4806

Theoretical models for the structure and properties of extragalactic double radio sources are compared with observations of these objects. It is shown that the twin exhaust model of Blandford and Rees (1974) adequately explains the data. The model is refined through the introduction of parameters related to constraints imposed by observations. Time dependent special relativistic equations for the motion of a relativistic fluid through channels of variable and changing cross section are then derived. The coupled evolution equations are nondimensionalized and a scaling law relating configurations of a constant reduced luminosity at specific dimensionless times is predicted. This system of equations is then solved numerically. Models for many different values of internal luminosity and for differing parameters of the confining mass of gas (size, density, temperature, shape) are computed, and the scaling law is verified. Finally, the possible sources of energy and plasma proposed for such objects are examined. Dissert. Abstr.

N77-24048*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STUDIES ON SOLAR HARD X-RAYS AND GAMMA-RAYS: COMPTON BACKSCATTER, ANISOTROPY, POLARIZATION AND EVIDENCE FOR TWO PHASES OF ACCELERATION Ph.D. Thesis - Maryland Univ.
Taeil Bai Apr. 1977 159 p refs
(Grant NGL-21-002-316)
(NASA-TM-X-71309; X-660-77-85) Avail: NTIS HC A08/MF A01 CSCL 03B

Observations of solar X-rays and gamma-rays from large flares show that the hard X-ray spectrum extends into the gamma ray region, where a flattening in the spectrum of the continuum emission is observed above about 1 MeV. This emission is believed to be due to bremsstrahlung. In addition to electron-proton

collisions, at energies greater than approximately 500 keV, bremsstrahlung due to electron-electron collisions becomes significant. Bremsstrahlung production was calculated for a variety of electron spectra extending from the nonrelativistic region to relativistic energies and electron-electron bremsstrahlung is taken into account. By comparing these calculations with data, it is shown that the flattening in the spectrum of the continuum emission can be best explained by an electron spectrum consisting of two distinctive components. This evidence, together with information on the X-ray and gamma ray time profiles, implied the existence of two phases of acceleration. The first phase accelerates electrons mainly up to about several hundred keV; the second phase accelerates a small fraction of the electrons accelerated in the first phase to relativistic energies and accelerates protons to tens and hundreds of MeV. Author

N77-24049# Brookhaven National Lab., Upton, N.Y.
LARGE p/SUB T/ PRODUCTION IN 10 TO THE 4TH POWER - 10 TO THE 7TH POWER GeV INTERACTIONS
T. K. Gaisser Jul. 1976 24 p refs Presented at the 7th Intern. Colloq. on Multiparticle Reactions, Tutzing, West Germany, 21-25 Jun. 1976 Sponsored in part by NSF Prepared in cooperation with Franklin Inst., Swarthmore, Pa.
(Contract E(30-1)-16)
(BNL-21650; Conf-760672-1) Avail: NTIS HC A02/MF A01

Evidence for high transverse momentum in cosmic ray interactions is reviewed in the context of models with hard collisions of partons and jet production. Two types of experiments suggest significant production of secondaries with high p/sub T/ above 10000 GeV. The cosmic ray data is compared to hard scattering models and further analysis needed to distinguish such models from other possibilities for production of large transverse momentum is discussed. ERA

N77-24050*# West Florida Univ., Pensacola.
NUCLEAR EMULSION MEASUREMENTS OF THE DOSE CONTRIBUTION FROM TISSUE DISINTEGRATION STARS ON THE APOLLO-SOYUZ MISSION Technical Report, Jul. 1976 - Mar. 1977
Hermann J. Schaefer Mar. 1977 15 p refs Prepared for the NASA Johnson Space Center
(Contract N00014-76-C-0544; NR Proj. 105-860)
(NASA-CR-151349; Rept-2) Avail: NTIS HC A02/MF A01

A total of 996 disintegration stars were prong-counted in two 100 micron Ilford K.2 emulsions from the dosimeter of the Docking Pilot on Apollo-Soyuz. The change of slope of the distribution at a prong number of about 6 or 7 indicates 219 stars as originating in gelatin. Applying the QF values set forth in official regulations to the energy spectra of the proton and a alpha prongs of the gelatin stars leads to a tissue star dose of 7.8 millirad or 45 millirem. The quoted values do not include the dose contribution from star-produced neutrons since neutrons do not leave visible prongs in emulsion. Nuclear theory, in good agreement with measurements of galactic radiation in the earth's atmosphere, indicates that the dose equivalent from neutrons is about equal to the one from all ionizing secondaries of stars. Application of this proposition to the star prong spectrum found on Apollo-Soyuz would set the total tissue star dose for the mission at approximately 90 millirem. Author

N77-24051# Franklin Inst., Swarthmore, Pa.
STUDY OF COSMIC RADIATION NEAR THE EARTH'S NORTH GEOMAGNETIC POLE Final Report, 1 Aug. 1975 - 30 Jun. 1976
Martin A. Pomerantz Hanscom AFB, Mass. AFGL 8 Sep. 1976 84 p refs
(Contract F19628-76-C-0047)
(AD-A031497; AFGL-TR-76-0201) Avail: NTIS HC A05/MF A01 CSCL 04/1

The nucleonic intensity observations at Thule, Greenland have established an apparently longer data base than any other station in either polar cap. During the brief period covered by this report, significant progress has been made toward understanding three important phenomena: (1) the origin of transient cosmic ray intensity variation; and (2) the mechanism that is responsible for producing north-south anisotropy and acceleration of relativistic cosmic rays between converging interplanetary shock waves. These results are described in detail. Author (GRA)

99 GENERAL

No abstracts in this category.

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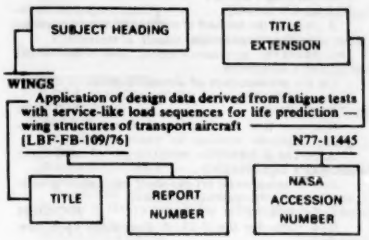
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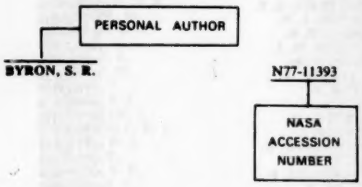

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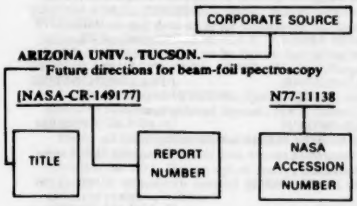

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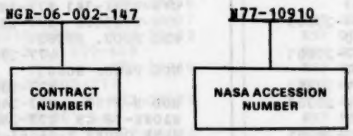

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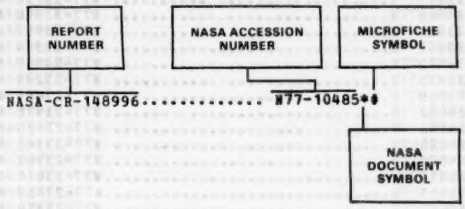

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